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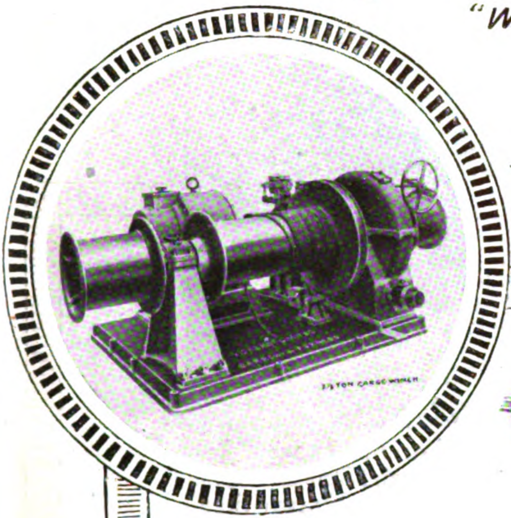

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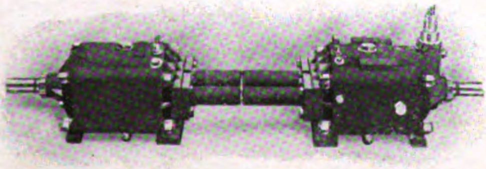

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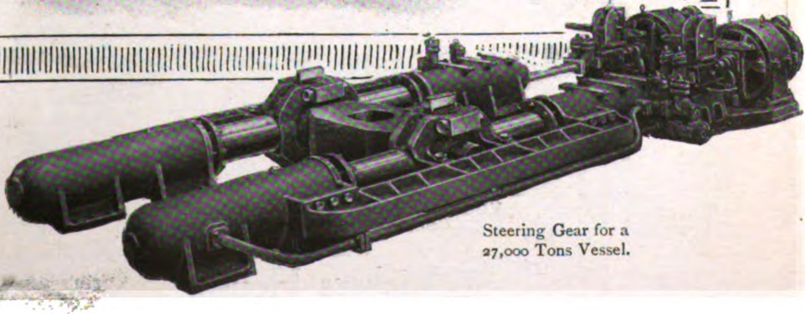

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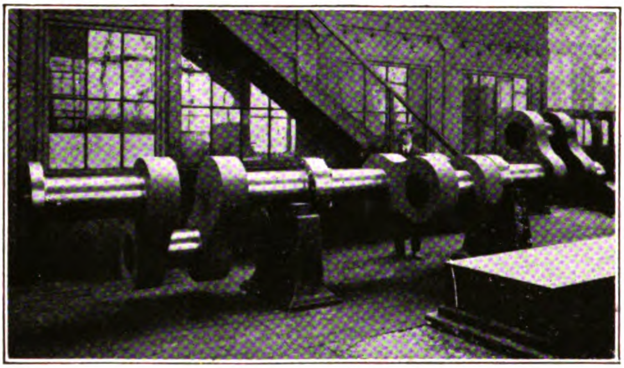

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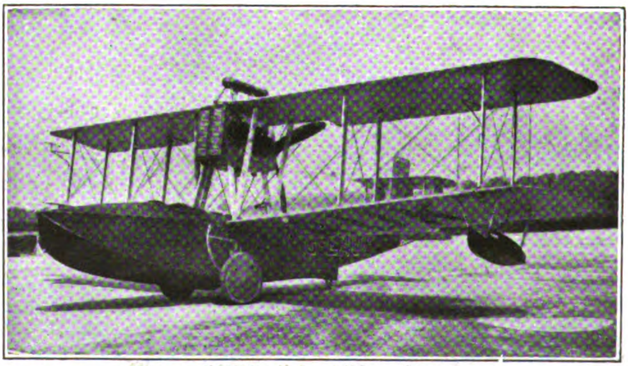

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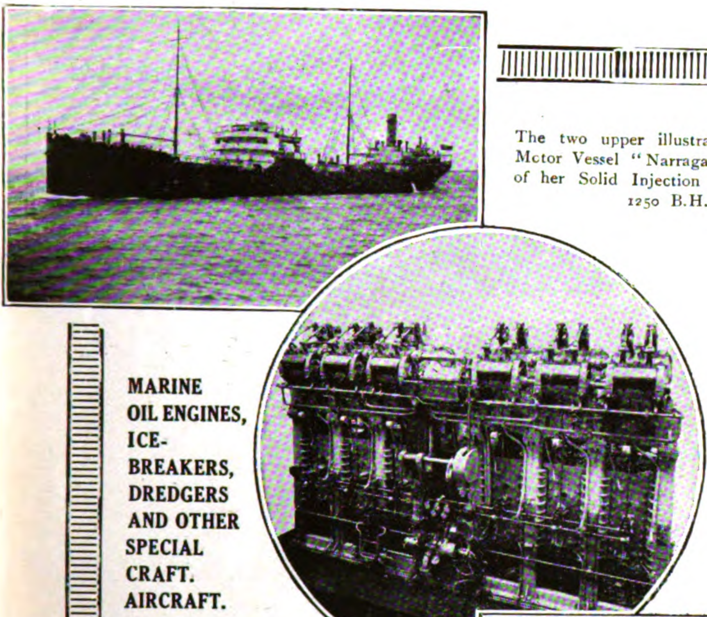

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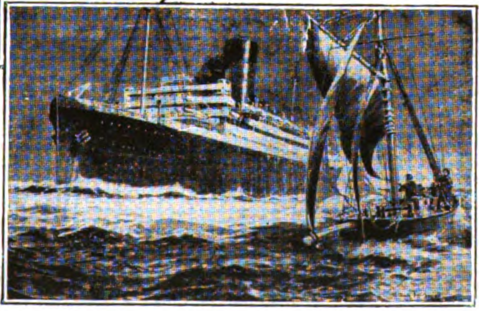

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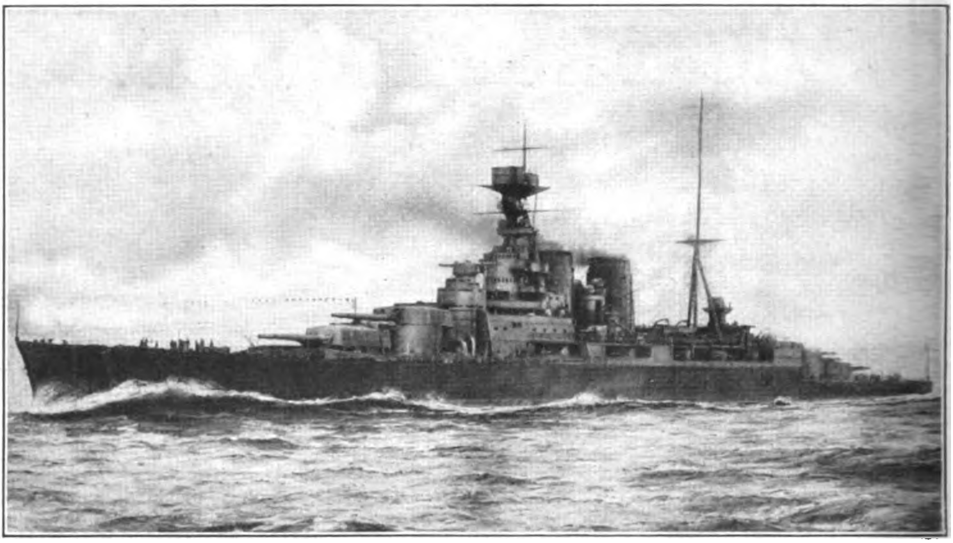

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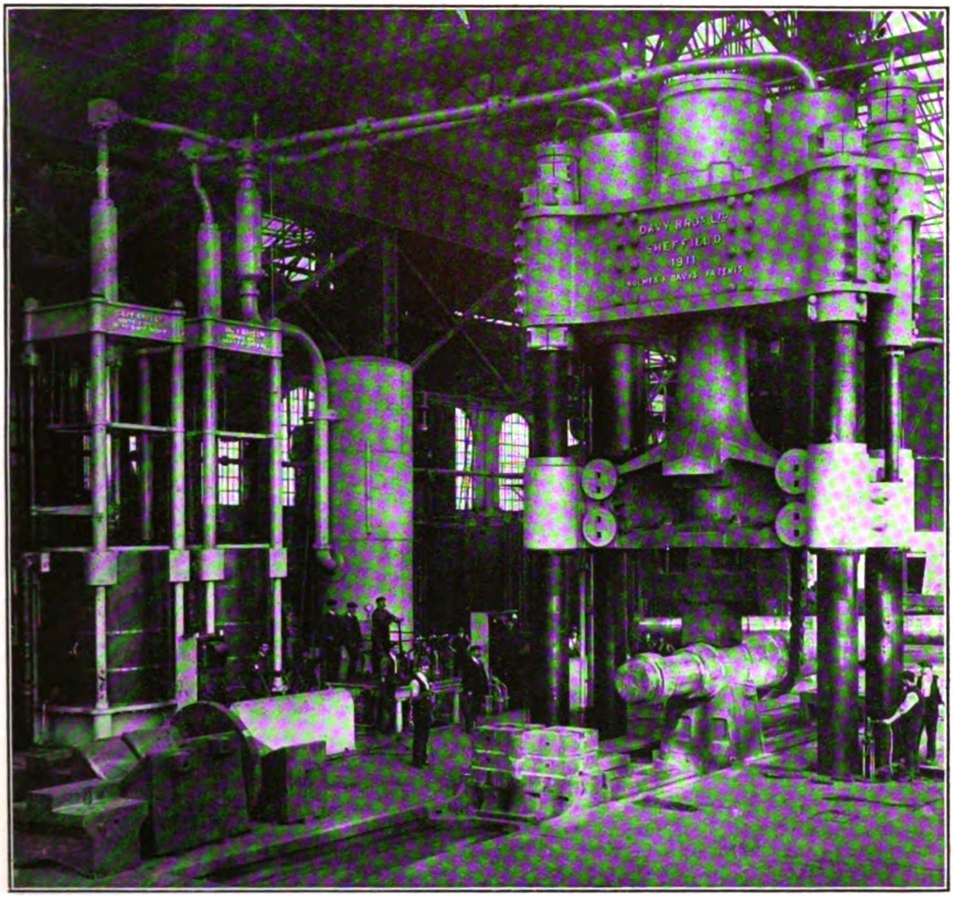

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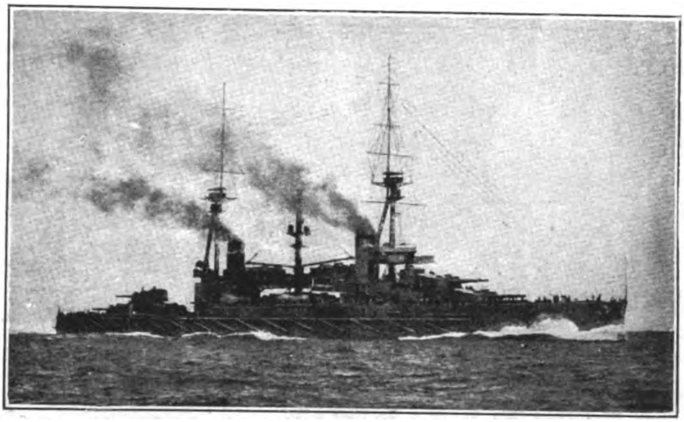

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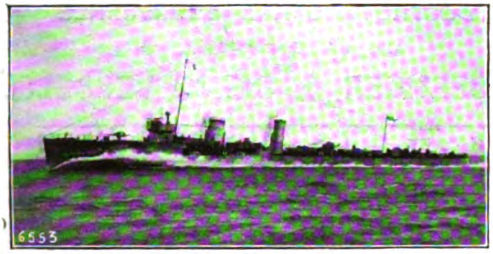

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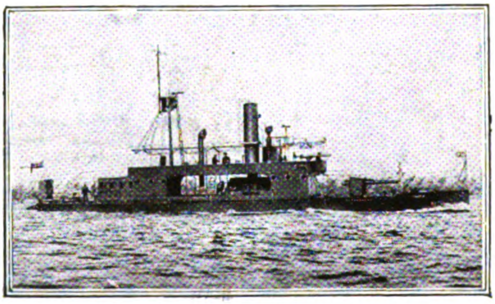

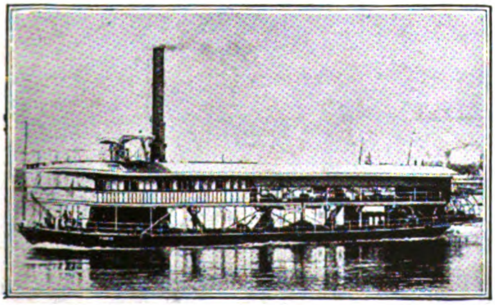

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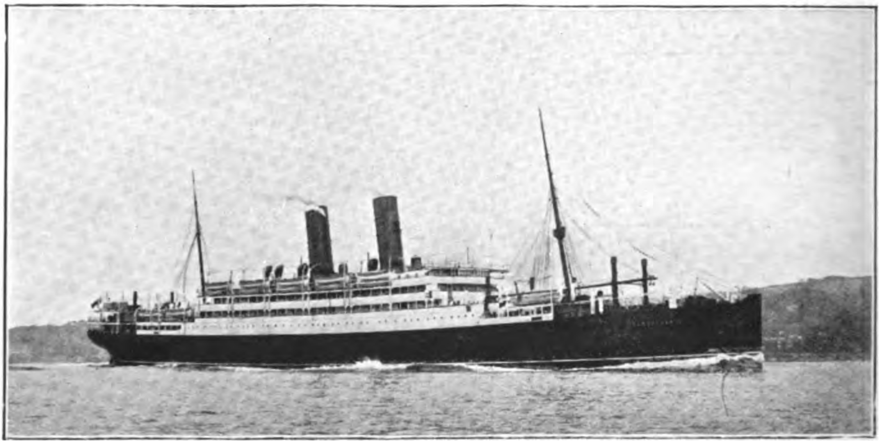

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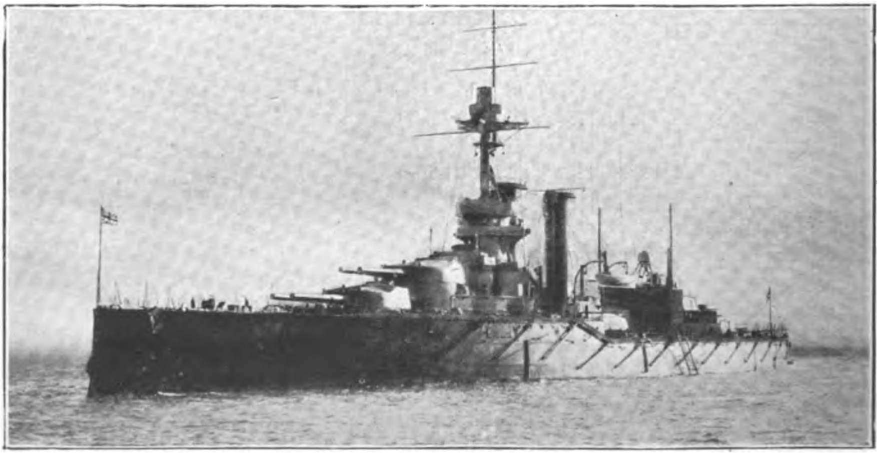

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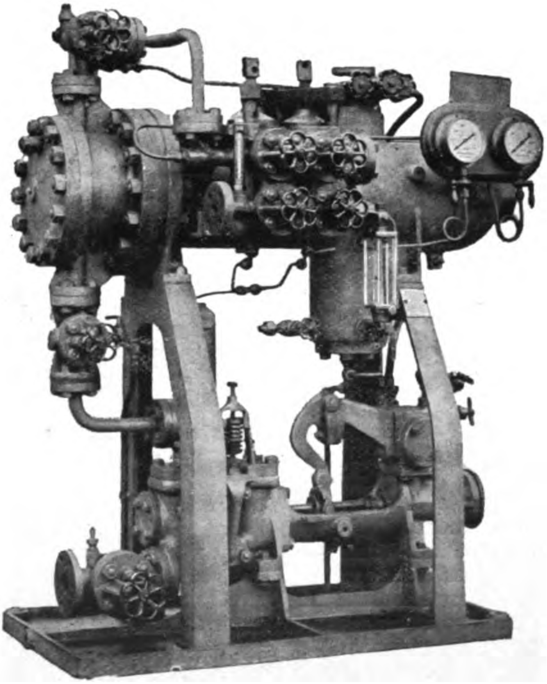

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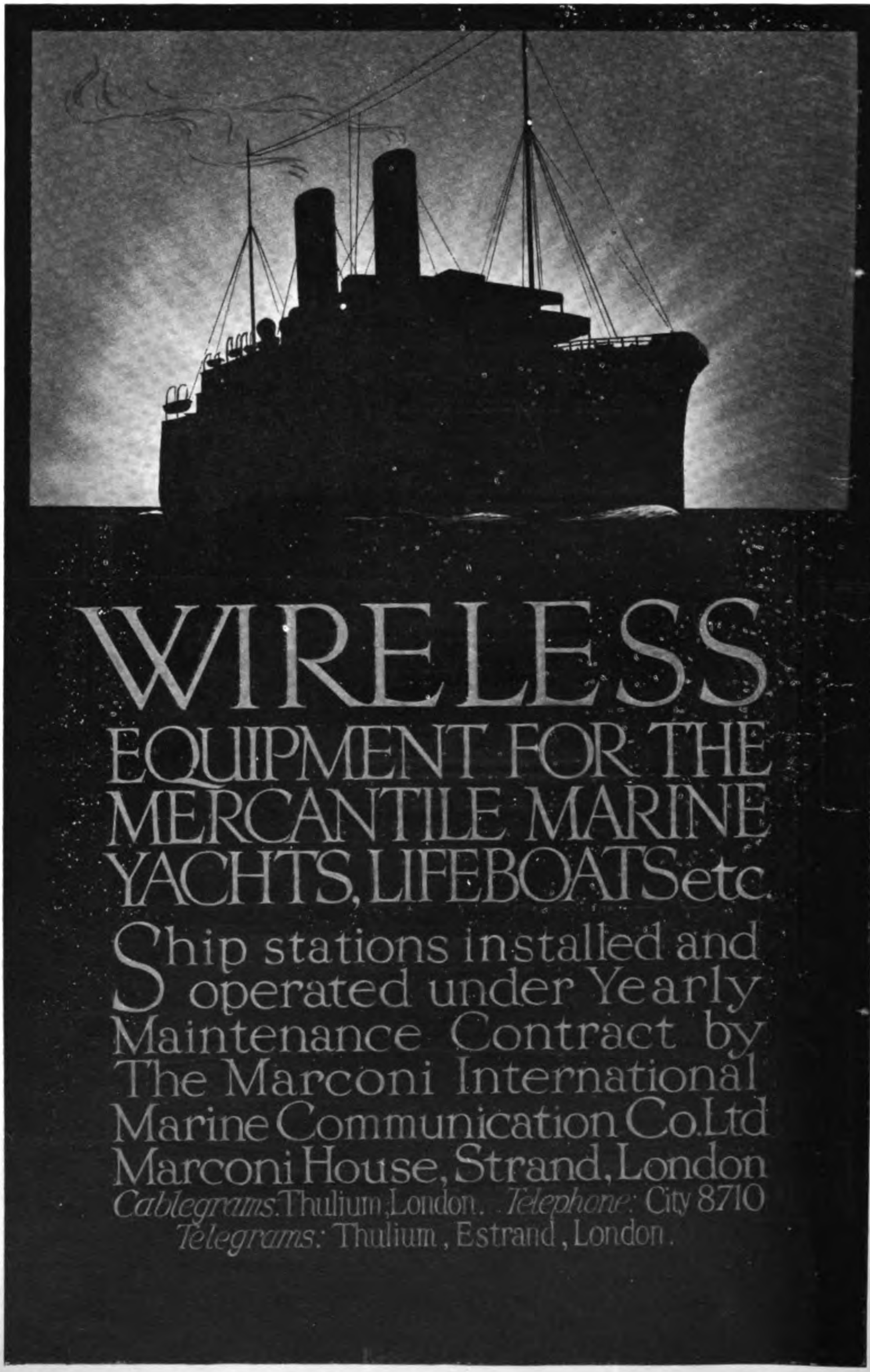

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PREFACE.

THE death under tragic circumstances of the second Earl Brassey severed an honourable association of his family with the maritime interests of the British Empire. The trustees have passed on to us the rights in "Brassey's Naval Annual," and with them the responsibility of carrying on the work which the first peer began upwards of thirty years ago. We regard this as an honour as well as a duty. The success achieved by the first Lord Brassey, when there was little national appreciation of the importance of sea power, was fully maintained by his son, and it will be our aim to support what may be described as "the Brassey tradition." We are pleased to have secured the continued co-operation of Commander Charles N. Robinson, R.N., and Mr. John Leyland, who have for many years assisted in the preparation of this work.

The transition of the Royal Navy from a war to a peace footing involved problems of great magnitude and complexity. The work of demobilisation and reconstruction has now been completed, and for the first time it is possible to survey the achievement in due perspective and to note the tendencies of naval policy.

The need for official reticence as to the original scientific and engineering work which was carried out for the Navy during the Great War no longer exists, and the pages of the "Annual" reveal how much was done, of which little could be said while the struggle continued. Engineer Vice-Admiral Sir George Goodwin, Engineer-in-Chief of the Fleet, directs attention to the importance of continuous experiment in naval engineering, in the interest of the Navy as well as of the Mercantile Marine; and Mr. J. Buckingham, of the Department of Scientific Research and Experiment at the Admiralty, contributes an article on applied science and invention in the Navy during the war. The necessity for maintaining a Naval Staff under peace conditions, if the Fleet is to be ready for any emergency which may arise, is also discussed.

Particulars are published of the progress of foreign navies, special reference being made to the large shipbuilding programmes of the United States and Japan; and the usual comparative tables of the present and prospective strength of the navies of the world are given with a critical examination of the statistics. A new situation has developed and this country's supremacy is no longer assured. The lessons enforced by the Battle of Jutland have rendered all the capital ships designed before that event more or less obsolescent, and the United States and Japan are the only two countries engaged in building heavy ships. The capital ship, by general admission, still holds its place as the dominating unit in all plans for future naval development; and Sir George Thurston discusses the future of this type of man-of-war.

All the recognised features of the "Annual" are continued, and the same close attention has been devoted to the naval interests of this and other countries as secured for this publication in the past general recognition as the leading exponent of thought on naval problems of the moment, and as the reliable reference book on warship design and equipment.

But, in view of the close ties which were cemented during the Great War between the Royal Navy and the Mercantile Marine, it has been thought desirable from now onwards to devote a section of the "Annual" to merchant shipping and its varied problems. This development is in complete accord with the breadth of view and statesmanlike wisdom of the first Earl Brassey, who, as a member of the Board of Admiralty, and later on as a private individual, continually reminded the nation that its Navy would be paralysed in time of war unless it was supported by a Merchant Fleet of great size and high efficiency.

This publication will, therefore, be known in future as "Brassey's Naval and Shipping Annual." It is appropriate that in the first issue published under these changed conditions, Admiral of the Fleet Viscount Jellicoe should have written an illuminating article on the services which the Mercantile Marine rendered during the Great War. As the first Commander-in-Chief of the Grand Fleet and, subsequently, as First Sea Lord of the Admiralty, Lord Jellicoe had peculiar opportunities of studying the work of our Merchant seamen. It is apparent from his article that the Allies could not have won the war without the support of British Merchant ships, and, still more important, of British Merchant officers and men.

The political, technical, and commercial aspects of Merchant Shipping are discussed by a group of authorities who write with personal knowledge and experience. Sir Westcott Abell, Chief Surveyor of Lloyd's Register, who has recently returned from the United States, describes the remarkable shipbuilding movement undertaken by the Americans, and particulars are also given of the United States Marine Act, 1920. Mr. James Richardson examines the development of the marine oil engine, to which increasing importance is attached. Other contributors include Mr. W. J. Noble, President of the Chamber of Shipping, who deals with the mission of the "tramp" in the movement of the ocean-borne commerce of the world; Sir W. E. Smith, late Director of Naval Construction, who describes the important work of The William Froude National Tank; Sir Frederick W. Lewis, who discusses the Economics of Shipping; Sir O. G. Holmden and Mr. J. W. Eason.

It is a peculiar source of gratification that the First Lord of the Admiralty and the Controller of Shipping should have given "Brassey's Naval and Shipping Annual" their good wishes, and we have to acknowledge also the assistance received from leading officers of the Navy, as well as from many of the principal shipowners of the country. In the preparation of the statistical matter which appears at the end of this volume, officials of the Admiralty, the Board of Trade, the Ministry of Shipping, Lloyd's Register, and the Chamber of Shipping have given invaluable aid.

ALEXANDER RICHARDSON.
ARCHIBALD HURD.

NAVAL SECTION.

FOREWORD.

I HAVE been asked to write a few lines as a "Foreword" for the next edition of "Brassey's Naval and Shipping Annual," which I understand is being undertaken by my friend, Mr. Alex. Richardson, M.P., in association with Mr. Archibald Hurd.

I do not think it is possible to exaggerate the importance of this Annual to the Naval, Mercantile Marine, and indeed the general community throughout the Empire. There can be no doubt that the work originally undertaken by the first Lord Brassey and carried on with so much energy by his son, whose tragic loss we all deplore, was of the greatest importance to the Empire, and served to arouse and keep alive a keener and more intelligent interest in naval questions than had existed before.

It is with this object in view that I would desire to impress upon my countrymen the vital necessity of a Navy adequate for our protection at home and for the maintenance of the highways of the ocean for our trade and commerce. It has always been a great power for peace; it has made the United Kingdom and the British Empire what they are to-day; and it would be a profound mistake if the country were to allow the Navy to be decreased in strength below the standard which the naval advisers at the Admiralty believe to be essential to our security. It is also in the hope that this Annual will continue to maintain the close connection between the Navy and the Mercantile Marine, that I desire to add my testimony to that which has already fallen from so many other people, to the fact that the Mercantile Marine rendered splendid service to the country during the late war, and proved itself to be an invaluable adjunct to the Royal Navy. I hope that this connection will become closer than ever in the future. Not only was there unity of purpose as regards the operations of naval and mercantile ships, but a closer bond between officers and men in both services. It was very clearly established during the war that there was a mutual dependence between the fighting and commercial fleets, and thus it is of first importance that the war-time relationship should not only continue but be strengthened. This can be better secured by unofficial agencies such as this "Annual," than by any Government action.

The primary duty of the Board of Admiralty is to see that, if the country give them the means by which they can provide a sufficient Navy, that Navy is efficient, thoroughly competent and able to do its work; and to secure this, there must be an expert Staff to work out all the various problems, and enable the Navy to be ready at any moment to do the work of the Empire.

I am thankful to say that I believe at the present moment this condition of things is to be found existing—the Navy is both sufficient and efficient; and it is because I believe that the continuance of "Brassey's Annual" will prove a most valuable source of information and guidance in the future, that I am glad to wish it God-speed.

WALTER H. LONG.

CHAPTER I.

THE BRITISH NAVY.

DEMOBILISATION AND RECONSTRUCTION.

Two distinct series of Navy Estimates have been presented to Parliament, one the belated Estimates for 1919–20, which were published on December 5, 1919; and the other the Estimates for 1920–21, which appeared about the usual time on March 12, 1920. Other factors combine to make a survey of British naval affairs of particular interest. There is the most unusual circumstance that no programme of warship building is in hand. This is unique in modern history. Furthermore, the Navy had been deprived during the period under review of a number of ships which, whether regarded by their sum-total or by their power, is certainly unprecedented, whole classes of vessels having been sold or otherwise disposed of. Whether in regard to its administration, organisation, or personnel, the Navy during the past year and a half has been passing through an important and engrossing period.

The complete operation of transforming the Navy from a war to a peace footing is bound to take time, and in the circumstances it is not surprising that Mr. Walter Long, the First Lord, should have indicated on more than one occasion that a definite naval policy has not yet been adopted. He has reminded the House of Commons that the condition of the world has been unsettled, and that it has been impossible to tell what the immediate consequences of the armistice would be. For these and other reasons it was impossible for the Board to formulate a policy. Introducing the Navy Estimates on March 17, 1920, however, Mr. Long said that the Admiralty were for the first time presenting real Peace Estimates to the House of Commons. These Estimates, and the policy which they represent, are largely based upon war experience. The whole world has been changed by the war, and the policy of the Admiralty must be constructed upon that basis. "We have to try," said Mr. Long, "to look into the new future with as far-seeing eyes as we can command." The Admiralty believe that in connection with the Estimates of the current year they have made proposals which are consistent at once with strong economy and full efficiency.

Another feature of special interest which should not be overlooked is that an entire change has been made since the last issue of the "Annual" was prepared, in the naval members of the Board of Admiralty. As First Sea Lord and Chief of the Naval Staff, Admiral of the Fleet Earl Beatty came into office on November 1, 1919, in succession to Admiral Sir Rosslyn Wemyss. The latter had held this most arduous and responsible post since January 10, 1918, prior to which he was for four months Deputy First Sea Lord. In recognition of his eminent services during the war, the King was pleased to confer a barony of the United Kingdom upon Sir Rosslyn, who took the title of Baron Wester Wemyss, of Wemyss, in the County of Fife His Majesty was also pleased to approve of the special promotion of Lord Wemyss to be an additional Admiral of the Fleet. As Second Sea Lord and Chief of Naval Personnel, Vice-Admiral Sir Montague Browning joined the Board on March 31, 1919, after his return from German ports in the Hercules, in succession to Vice-Admiral Sir Herbert Heath. Sir Montague was himself succeeded by Sir Henry Oliver on September 27, 1920. As Third Sea Lord and Controller, Rear-Admiral Frederick L. Field assumed office in March, 1920, succeeding Rear-Admiral Sir William Nicholson, who had only joined the Board in the previous July. To the members of the Institute of Metals, on March 12, 1920, Sir William Nicholson said, in a speech replying to the toast of the Imperial Forces, that he would crave sympathy on behalf of the Navy for the enormous task in front of it. They were showered with books on how they should have done this or that, and who went wrong and why, but there was no constructive criticism. He could not believe that an Agapemone of love had now come upon the world—"either we have to maintain our command of the sea or lose it." The new Fourth Sea Lord, who was appointed on March 15, 1920, is Rear-Admiral the Hon. Algernon Boyle, who came from sea service in the Carysfort in the plebiscite areas of North Germany. Since June 17, 1919, Rear-Admiral Sir Alfred Chatfield, late Flag-Captain to Admiral Beatty in the Grand Fleet, had been Fourth Sea Lord, but on being succeeded by Rear-Admiral Boyle he assumed a post of closer relationship to his former chief, viz. that of Assistant Chief of the Naval Staff. As will be seen from an examination of the "Notes on Naval Policy" issued by the Board, and reprinted in Part III. of the "Annual," this officer is now responsible from the Staff side for the development and use of material, including types of vessels, weapons, and tactics. The Deputy Chief of the Naval Staff, whose responsibility is concerned with operations, policy, intelligence, and training, is Vice-Admiral Sir Osmond Brock, who was appointed on August 4, 1919. On this date, the appointment of Deputy First Sea Lord lapsed. It had been held since January 10, 1918, by Rear-Admiral Sir George Hope, who was appointed to command the Third Light Cruiser Squadron in the Mediterranean. The naval representatives with seats on the Board were thus reduced from seven to six, as compared with four before the war. In a speech on July 24, 1919, Mr. Long said:—

> At all events for the present, whatever we may find to be necessary when we have had a year's experience, I do not think we can hope to deal with the staff problem without two high officers in the Admiralty in the position of the two officers I have referred to, the Deputy and the Assistant Chief of the Naval Staff. . . . Our desire is that there should be there a competent body of men, whose business it will be to be always studying these great war problems and to be able to keep the Admiralty abreast of all that is going on in the world; and in addition to that we are profoundly anxious that we shall take advantage also of the wonderful inventions of the war.

Important changes also occurred during the past year on the civil side of the Admiralty. It is fitting to mention as chief among these the transfer of Dr. T. J. Macnamara on his elevation to Cabinet rank as Minister of Labour. Dr. Macnamara had completed twelve years as Parliamentary and Financial Secretary when the appointment of his successor, Colonel Sir James Craig, Bart., was officially announced on April 3, 1920. He had held office under three successive governments, and had displayed high ability and indefatigable industry in dealing with the problems of his post. He had an unrivalled grasp of details concerning questions affecting the pay, conditions, and general welfare of the personnel of the Fleet and the dockyard officials and workmen, and his tact and urbanity were generally recognised. Mr. Long, in his speech on the Estimates on March 17, 1920, bore testimony to the splendid loyalty and generous goodwill with which Dr. Macnamara had aided him.

The Secretary's Department at the Admiralty sustained a great loss on May 28, 1920, by the death of Mr. John W. S. Anderson, C.B., who had been Assistant Secretary since 1917. He was but forty-six years of age, and his health undoubtedly suffered by the heavy burden of administrative work thrown upon the department by the war, and the zeal and devotion to duty which he showed. As Director of Naval Stores, Sir George Ashdown retired on May 31, 1920, after a career extending over forty-eight years, and Mr. J. W. L. Oliver was appointed to succeed him. Only two chiefs of the civil departments at the Admiralty have held office all through the war period. These are Sir Eustace d'Eyncourt, Director of Naval Construction, and Sir J. H. Brooks, Director of Victualling.

POST-WAR POLICY AND FLEETS.

Though an ultimate or permanent policy for the post-war Navy cannot yet be said to have been wrought out, the lines along which development is proceeding will be found clearly set forth in the comprehensive and illuminating document issued by the Admiralty as a Parliamentary Paper on March 15, 1920 (Cmd. 619). It is a long time since anything containing such a revelation of the decisions of the Board has been published. Speaking at the anniversary festival banquet of the Highland Society on March 29, 1920, Lord Beatty said that the Navy had been called the Silent Service, but in the previous week it had broken the silence. The Admiralty had taken the Empire into their confidence, and in the statement of policy which accompanied the Navy Estimates the world at large was told of the problems which the Board were thinking about. Many of them were controversial, and Lord Beatty said he hoped they would produce fair and constructive criticism.

> We are trying (he said) to meet the problems in a spirit of advancement coupled with economy. But the economical side, which is most important, and which we have not lost sight of, requires a note of warning. You cannot have a really valuable thing without paying for it. We came into being by the sea, we exist by the sea, and the day that we forget it, and forget sea power and all that it means, the British Empire will crumble to the ground.

The Grand Fleet was officially abolished on April 7, 1919, when Sir David Beatty hauled down his flag. The principal ships of its First Battle Squadron—which numbered nine units at the time of the German surrender—were taken to form the First Battle Squadron of the new Atlantic Fleet, the principal force in the post-war organisation. These were the Revenge, Resolution, Ramillies, Royal Oak, and Royal Sovereign. The Fifth Battle Squadron, composed of the Barham, Malaya, Warspite, and Valiant, became the Second Battle Squadron, Atlantic Fleet; and the First Battle-Cruiser Squadron, consisting of the Repulse, Renown, Princess Royal, and Tiger, with the Lion, Fleet-Flagship of the Battle-Cruiser Force in the Grand Fleet, became the Battle-Cruiser Squadron, Atlantic Fleet. These squadrons were commanded respectively by Vice-Admiral Sir Sydney Fremantle (First), Vice-Admiral Sir Arthur Leveson (Second), and Acting Vice-Admiral Sir Roger Keyes (Battle-Cruisers). A Flying Squadron was also formed under Rear-Admiral Sir Richard Phillimore in the Furious, consisting of that vessel and the Argus, Nairana, Pegasus, Vindex, and Vindictive. On May 1, the Harwich Force under Rear-Admiral Sir Reginald Tyrwhitt ceased to be known as such. A First Light Cruiser Squadron was formed for the Atlantic Fleet, composed of the Curacoa, Coventry, Curlew, Danae, Dauntless, and Dragon, and on Sir Reginald being appointed Senior Naval Officer at Gibraltar, Rear-Admiral Sir Walter Cowan, who in the Caledon had been in command of the First Light Cruiser Squadron, Grand Fleet, transferred to the Curacoa to command the new squadron. As new ships became available, the "C" type cruisers in his command were replaced by those of the "D" class, and his flag was hoisted in the Delhi. The destroyer force allocated to the Atlantic Fleet at first was three flotillas, each consisting of a depot-ship, two flotilla leaders, and sixteen destroyers, with the light cruiser Castor as flagship of the Commodore (D). Four submarine flotillas, composed of from nine to twelve boats each, and based respectively on Rosyth, Chatham, Portsmouth, and Devonport, were also included in the organisation of the Fleet. Admiral Sir Charles Madden, who had been Second-in-Command of the Grand Fleet during the last two years of war, and formerly Chief of the Staff to Admiral Jellicoe, was appointed Commander-in-Chief, with the Queen Elizabeth as his Fleet-Flagship.

Sir Charles Madden's command also included a second Fleet which was constituted for duty—the Home Fleet, of which Vice-Admiral Sir Henry Oliver was appointed Vice-Admiral Commanding. This included a Third Battle Squadron, composed of the King

George V., Orion, Conqueror, Monarch, Thunderer, and Erin, which vessels had formed part of the Second Battle Squadron of the Grand Fleet. One Light Cruiser Squadron, the Second, was formed, principally of ships from the First Light Cruiser Squadron, Grand Fleet, viz. the Caledon, Carysfort, Cleopatra, Galatea, Phaeton, and Royalist, and on May 14, 1914, Commodore A. A. M. Duff hoisted his broad pennant in the Caledon to command this squadron. The Home Fleet was also allotted two destroyer flotillas, the Fourth and Fifth, and a Minelayer Squadron of which the Princess Margaret was flagship. On grounds of economy, the Home Fleet was on October 1, 1919, ordered to be reduced to a reserve basis, and from this date the title of Admiral Sir Charles Madden, who had been styled Commander-in-Chief, Atlantic and Home Fleets, was altered to that of Commander-in-Chief, Atlantic Fleet. On October 31, the Home Fleet was abolished. Its Second Light Cruiser Squadron was transferred to the Atlantic Fleet, as was its Fourth Destroyer Flotilla, so that this Fleet now had two light cruiser squadrons and four flotillas of destroyers. A further move in the direction of economy, however, was the reduction of the submarine flotillas from four to three, known as First, Second, and Third respectively, with bases at Rosyth, Devonport, and Portsmouth.

At the time the Home Fleet was formed, Reserve Divisions were also inaugurated at each of the home ports, under the charge of rear-admirals. The officers appointed to these Divisions were: Rear-Admiral H. L. Mawbey (the Nore); Rear-Admiral Cole C. Fowler (Portsmouth); Rear-Admiral Maurice Woollcombe (Devonport); and Rear-Admiral C. F. Corbett (Rosyth). The effect of the Home Fleet's abolition was to merge the remnants of that force into the Reserve, and Vice-Admiral Oliver was appointed Vice-Admiral Commanding the Reserve Fleet (short title, V.A.R.F.), the rear-admirals under his orders taking the title of Rear-Admiral, Reserve Fleet (short title, R.A.R.F.). A fifth division of the Reserve was formed at Portland, composed of what was formerly the Third Battle Squadron, Home Fleet, and Rear-Admiral Sir Douglas Nicholson, who had been Rear-Admiral Commanding that Squadron, became Rear-Admiral, Reserve Fleet, Portland. On the expiration of his term, he was succeeded by an officer of captain's rank as Senior Officer, Reserve Fleet, Portland. The minimum complements allocated to the ships of the Reserve varied from 10 per cent. of full complement in the large ships, to nearly 20 per cent. in the smaller ships. In addition to the vessels for which the flag officers were directly responsible, the latter had charge of a large number of ships which were paid off after the armistice or after the signing of peace, and which, although not required for naval use again, needed a considerable personnel to look after them until they were disposed of by sale or otherwise. It was officially stated on March 31, 1920, that for the most part none of the ships of the Reserve had been to sea for practice since they joined the Reserve. A test mobilisation of certain vessels, including the battleships Orion, Conqueror; and King George V., the light cruisers Royalist, Aurora, and Galatea, the Dido (Captain (D)), the flotilla leaders Nimrod, Saumarez, and

Abdiel, and three half-flotillas of destroyers, twenty-four boats in all, took place in July, 1920, when exercises on a small scale were carried out from Portland for a period of about ten days. On grounds of economy, this test did not include any manœuvres on a large scale at sea, nor combined exercises with the fully manned squadrons.

As regards the remaining battleship strength after the armistice, six vessels, the Iron Duke, Emperor of India, Benbow, Marlborough, Ajax, and Centurion, were ordered to form the Fourth Battle Squadron for the Mediterranean. These ships had been in the First or Second Squadrons of the Grand Fleet, the Iron Duke, of course, being Admiral Jellicoe's flagship during the first two years of the war and at Jutland. The force agreed upon for the Mediterranean was six battleships, six light cruisers (known as the Third Light Cruiser Squadron), a destroyer flotilla of sixteen vessels, with leaders and depot-ship, and a submarine flotilla. It will be seen that of the twenty-nine British battleships in commission in the Grand Fleet at the armistice, twenty-two were retained in the post-war organisation in the Atlantic, Home, and Mediterranean Fleets; the other seven—the Canada, Agincourt, Hercules, Neptune, St. Vincent, Colossus, and Bellerophon—were reduced to reserve or employed on subsidiary duties.

Fleets in Distant Seas.

The Mediterranean was the only station abroad to which battleships were allotted in the post-war arrangements. All the others received a cruiser squadron of four ships each, the Fourth Light Cruiser Squadron being sent to the East Indies, the Fifth to China, the Sixth to the Cape, the Seventh to South America, and the Eighth to North America and the West Indies. Certain modifications have been made in the details of this organisation, but in principle it remains in force. In China, the Hawkins, first of her type, became flagship of the Commander-in-Chief in the autumn of 1919, arriving on the Station to assume her duties on November 8. From May 6, 1920, the appointment of Rear-Admiral commanding the Fifth Light Cruiser Squadron on this Station lapsed, and Rear-Admiral G. H. Borrett became on this date Senior Naval Officer in the Yangtse. In the East Indies, the Carysfort, originally selected as flagship, was replaced by the obsolete cruiser Highflyer, which was refitted at a cost of over £95,000. Rear-Admiral Sir Hugh Tothill hoisted his flag in her on August 1, and assumed command of the Station on November 15, 1919.

As regards the smaller craft on foreign stations, there are attached to the Mediterranean Fleet two sloops for duty in the Red Sea; and three river gunboats and six motor launches for service on the Danube, where a post-captain, with the title of Senior Officer, Danube Flotilla, is in charge with his pennant in the Glowworm. In China, the force includes no destroyers, but there are twelve submarines, with two depot-ships; four sloops; and fourteen gunboats for river work. The Africa (formerly the Cape) Station has two sloops, and two gunboats for river work. In South America, there is one sloop, the Petersfield. In the East Indies, there are three sloops; one special service vessel, the Triad, for duty in the Persian gulf; and two river gunboats for the Tigris and Euphrates. The North American Station is allotted two sloops. For duty in the South Sea Islands, two sloops have been allotted to the New Zealand Station. On this Station the light cruiser Chatham, which has been presented to the Dominion, and the Philomel will be maintained by the New Zealand Government with volunteers for the New Zealand Naval Service. The defence of Australia is of course undertaken by the Royal Australian Navy.

In the important matter of aircraft-carrying ships, the hand of the economist has descended rather heavily. During a debate on national expenditure in the House of Commons on October 29, 1919, Mr. Austen Chamberlain, Chancellor of the Exchequer, indicated that reductions had been made in the post-war Fleet as the result of discussions between the Treasury and the Admiralty. One of these was the abolition of the Home Fleet, already mentioned. Another was the reduction of two battle-cruisers, one to the reserve and the other to the sale list. A third was the abolition of the Flying Squadron of the Atlantic Fleet, and its replacement by one ship only. On June 15, 1919, Rear-Admiral Sir Richard Phillimore hauled down his flag in the Furious as Admiral commanding the Flying Squadron, and transferred his duties to Captain W. S. Nicholson, formerly his Flag-Captain, who was ordered to be known as "Captain (A)" from the 16th June. Five months later, on November 21, 1919, the Furious was reduced to reserve complement at Rosyth, and as the Nairana, Pegasus, and Vindex had also gone from the Fleet, there remained only the Argus and Vindictive. On March 4, 1920, the reduction of the last-named to reserve at Portsmouth left only the Argus. By this date there were only three aircraft-carriers in the whole of the Navy in full commission—the Argus with the Atlantic Fleet; the Pegasus in the Mediterranean; and the Ark Royal in China. The very large number of officers and men required for the bigger aircraft-carriers, at a time when considerable reductions had taken place in the personnel of the Navy, was a factor in their being withdrawn from full commission.

FOREIGN STATIONS.

As with the distribution of ships, so with the limits of the various naval stations, important changes followed the return to peace conditions. The revised boundaries of the stations came into effect on June 1, 1919, except those between the Australian Station and the New Zealand Station on the one hand, and the Australian Station and the China Station on the other, which after consultation with the Dominions were adopted as from January 1, 1920. The Home Station is one of the smallest of the nine into which the oceans are now divided. It reaches northward into the Arctic Seas and southward to a little above the Cape Verde Islands; westward it extends to 40 degrees west longitude, nearly to the longitude of Cape Farewell, in Greenland, and on the east it naturally includes the whole of the North Sea and the Baltic. The Mediterranean Station includes Gibraltar, and extends from that base to the Straits of Bab-el-Mandeb. It therefore comprises the whole of the Mediterranean, and also the Red Sea and Suez Canal, a larger area than during the war. It may be recalled that about the end of August, 1914, in order to bring the limits of the East Indies Station into conformity with the strategical situation, the whole of the Red Sea, from Aden to Suez, was transferred to that station at the suggestion of Admiral Sir Richard Peirse, then Commander-in-Chief in the East Indies. It is now restored to the Mediterranean. The force in the latter sea also supplies representation of the British Navy in the Adriatic, the Danube, the Sea of Marmora, the Black Sea, and the Sea of Azof.

The limits of the China Station from east to west cover more than 80 degrees, or nearly one-fourth of the circumference of the globe. They also extend from below the equator, south of Borneo and other islands of the East Indian Archipelago, to the Arctic Circle. Included in the station are the Ladrones, and the Caroline and the Marshall groups of islands in the Pacific. The headquarters of the northern division of the Station are at Hong Kong and the southern at Singapore. The boundaries of the East Indies Station on the African coast have been enlarged, and now include Zanzibar and what was the littoral of German East Africa. The Cape of Good Hope Station has been renamed the African Station. Its headquarters remain at Simonstown, where there is a dockyard. Included in its limits is a huge stretch of the African coastline, from Cape Delgado, above Mozambique, on the west, to Cape Blanco on the east, a little to the southward of the Rio del Oro, where the German raider Kaiser Wilhelm der Grosse was destroyed by the Highflyer early in the war. It thus includes the whole of the coast of the Union of South Africa, and also what used to be German South-West Africa, as well as Togoland and the Cameroons, and also the island of Madagascar.

In the new limits of the North American and South American Stations, the influence of the Panama Canal is plainly seen. Ships on both the Atlantic and the Pacific shores of the American Continent are now included in one Station, under one Admiral. The old Pacific Station is abolished. There are two squadrons for duty in the waters of North and South America respectively, each allotted about the same area. The line of demarcation between North and South is placed, on the Atlantic side, a few miles above the equator, so that the Canal Zone comes into the North American Station, and all the waters off Brazil within the South American Command. The boundary on the Pacific side is placed more to the south, about 5 degrees South of the equator instead of 5 degrees North of it, so that the Galapagos islands come within the limits of the North American Station, and also the waters off Colombia and Ecuador; but those off Peru and Chile are, of

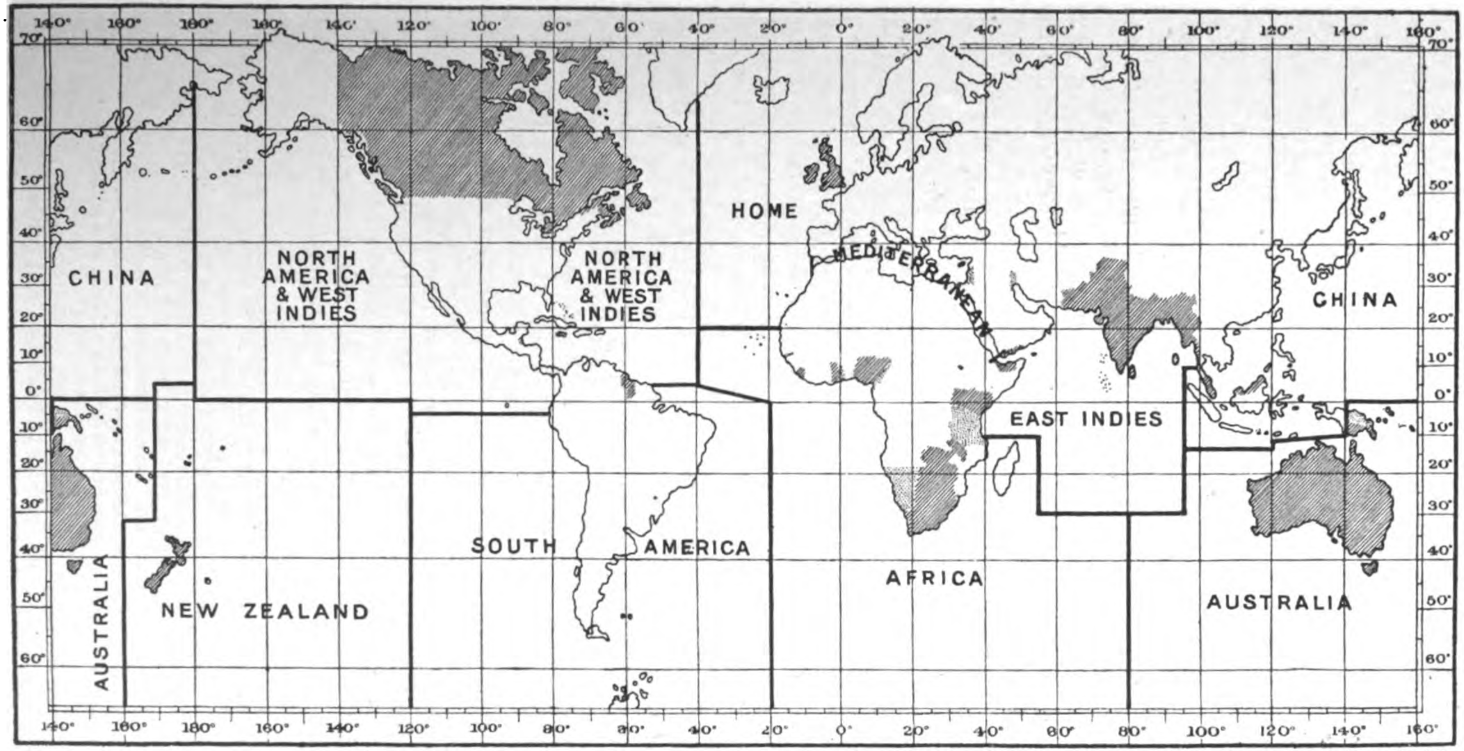

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CHART SHOWING LIMITS OF BRITISH NAVAL STATIONS.

(The British Empire is shown by ruling and the Mandatory Territory of the British Empire by stippling.)

course, within the South American Station. A curious feature about the new boundary of the Australian Station on the north is that it proceeds along the line of the equator from the western limits until it reaches New Guinea, and then crosses that island from north to south. Thus the Territory of Papua, formerly known as British New Guinea, and what was until the war German New Guinea, but is now administered by the Commonwealth Government under a mandate, come within the Australian Station, but the north-western or Dutch portion of the island is within the limits of the China Station. The boundary between the Australian and New Zealand Stations is drawn for the most part along the line of 160 degrees west longitude. The Bismarck Archipelago, the New Hebrides, and the Solomon Islands are allotted to the Australian Station, but the Fiji Islands belong to that of New Zealand. The eastern limit of the latter is thrown well out into the Pacific so as to include the whole of the Polynesian islands.

PROGRESS OF DEMOBILISATION.

Having now summarised the changes made after the armistice in the distribution of the fleets and squadrons, and the boundaries of the naval stations, it may be fitting to deal with the progress of demobilisation, first in regard to reductions in the naval bases and establishments; secondly, in the removal of ships no longer required for service; and thirdly, in the demobilisation of officers and men. In an order dated June 18, 1919, the Admiralty ordered that the main base of the Atlantic Fleet was to be Rosyth, and for the destroyer flotillas of the Fleet, Port Edgar, on the Firth of Forth. Similarly, the main base of the Home Fleet was ordered to be at Portland. Invergordon and Scapa Flow were to be used as exercising bases only. In August, 1919, the Admiralty published an outline programme of the proceedings of the Atlantic and Home Fleets throughout the year, which showed that it had been decided to abolish week-end leave in the Atlantic Fleet except when the ships were at their home or refitting ports, and, to compensate for the change, to increase the annual period of long leave from twenty-eight to forty-two days. Two periods of fourteen days each were to be given from the manning ports of the ships, and the third period from the refitting ports when the ships came in for docking. The Admiralty programme, it may be noted, was drawn up before the abolition of the Home Fleet, but it has not been revised officially, and is here given as issued :—

Mid-December to Mid-January.—Winter leave period for both Atlantic and Home Fleets.

February and March.—Atlantic Fleet visits foreign ports, carrying out exercises, etc. Home Fleet carries out drills and exercises from Portland.

April.—Spring leave period for both Atlantic and Home Fleets.

May, June, and July.—Atlantic and Home Fleets visit northern bases, and carry out practices and exercises. Manœuvres and regatta will be held.

August.—Midsummer leave period for both Atlantic and Home Fleets.

September, October, and November.—Atlantic Fleet cruises round Great Britain and Ireland, returning to the northern bases for drills, exercises, and experimental work. Home Fleet carries out drills and exercises from Portland.

As regards the naval bases required in connection with the foregoing programme, and for post-war needs generally, a revised organisation was adopted and came into force on January 1, 1920, by which certain portions of the home port commands were constituted as "areas" under the commands of captains, R.N. In addition, changes were made in the organisation of the Coastguard so as to bring the control of the stations more directly under the Commanding Officers of the respective Areas and the Commanders-in-Chief at the ports. The arrangement of the Coastguard into six "districts," each under a captain, was abolished. Instead there were ten main areas, of which the five in the vicinity of the Commanders-in-Chief at the Nore, Portsmouth, Devonport, Rosyth, and Queenstown are administered by a "Coastguard Captain" on the Staff of the Commander-in-Chief, while the other five are administered by the Captain Commanding the Area. The following is a list of these posts in the new organization: Under the Commander-in-Chief at the Nore there is a Coastguard Captain for the Nore Area and a Commanding Officer of Immingham Area. Under the Commander-in-Chief at Portsmouth there is a Coastguard Captain, who is also Senior Naval Officer at Southampton. There is also a Coastguard Captain on the staff of the Commander-in-Chief at Plymouth. Under the Commander-in-Chief on the Coast of Ireland, whose title was changed to that of Commander-in-Chief, Western Approaches, there is a Coastguard Captain at Queenstown, and Commanding Officers of the Irish Sea Area, the Kingstown Area, and the Buncrana Area. Under the Commander-in-Chief on the Coast of Scotland there is a Coastguard Captain at Rosyth and a Commanding Officer of the North of Scotland Area, with his headquarters at Lyness, Orkneys.

Simultaneously with the coming into force of this revised organisation for the home commands, the Admiralty arranged to close or reduce to a pre-war status all the surplus bases and stations, and to terminate appointments established during the war in connection with them. The Grand Fleet's war base at Scapa Flow was reduced to a peace footing on February 15, 1920, when Vice-Admiral Prendergast, Commanding the Orkneys and Shetlands, hauled down his flag. The naval base at Lerwick, which remained open until after the final return of vessels from the White Sea, was closed on December 13, 1919, when the appointment of Rear-Admiral Clement Greatorex as Senior Naval Officer in the Shetlands was terminated. Cromarty naval base was demobilised earlier in the year, when Rear-Admiral E. R. Pears relinquished the control, and a Captain-Superintendent was appointed in charge of the repair base at Invergordon. The command of the East Coast of England was held by Vice-Admiral Sir Edward Charlton as Vice-Admiral Commanding, with headquarters at Immingham, in the Humber. This officer hauled down his flag on August 30, 1919, when the naval bases in the Humber and Tyne reverted to the Nore Command. The Harwich Force ceased to exist as such on May 1, although a Harwich Detachment consisting of certain light cruisers and destroyers detached temporarily from the Atlantic and Home Fleets remained for a time under the general orders of the Admiralty. It was disbanded later in the year, and Harwich and Shotley reverted to a pre-war status under the Nore Commander-in-Chief. The naval bases at Lowestoft and Great Yarmouth were closed on November 30, 1919. The Dover Patrol officially ceased to exist on October 15, 1919, when Vice-Admiral Cecil F. Dampier hauled down his flag. The naval bases at Ostend and Zeebrugge had been closed on the 7th of the same month, and the appointment of Senior Naval Officer at Ostend abolished. Dover dockyard establishment, however, remained in being until the end of the financial year on March 31, 1920. At Milford, the flag of Admiral Sir Charles Dare was struck on July 31, 1919, on the termination of an admiral's command at that port; and similarly the appointment of the Rear-Admiral at Falmouth, held by Rear-Admiral John S. Luard, was abolished on August 15, 1919. It is unnecessary to refer to the many changes involved in the closing or reduction of the lesser known bases, of which well over a hundred of various kinds were demobilised. Among these were the bases at Thurso, Inverness, Dundee, Aberdeen, Granton, Blyth, Cardiff, Liverpool, Belfast, Fleetwood, Guernsey, and many others at home and abroad. They included Auxiliary Patrol bases, Convoy bases, Coaling stations, Motor-launch and Coastal Motor-boat bases, Kite-Balloon stations, Seaplane and Airship stations for naval patrols, Transport bases, and similar establishments necessary for the upkeep and efficient working of the vast and complex naval units called into being by the course of hostilities.

Obsolete Ships.

Next, the Admiralty had to arrange for the removal from the Navy of the hundreds of vessels of every type which had been rendered surplus to requirements by the comparatively sudden end of the war. It must be remembered that the signing of the armistice found the naval machine in full working and expanding its resources in almost every direction in anticipation of another enemy onslaught by sea. There was no gradual decline of effort, as in other long-drawn-out wars. Consequently the surplus material, including a good deal still uncompleted, which the Board found left on their hands was considerable.

A list dated April 9, 1919, of "Ships not required for further service," contained the names of the Africa, Dominion, and Hindustan, of the King Edward VII. class; the Duncan, Exmouth, and Albemarle, of the "Admiral" type; and four earlier battleships. Seventeen other vessels of the cruiser or torpedo gunboat types, ninety-seven destroyers, and forty-six torpedo boats, were also included. The general effect of this order was to remove from the effective list all vessels of the pre-Dreadnought era, so far as battleships and cruisers were concerned; and as regards destroyers, all vessels completed before 1909. Five classes of battleships, six classes of armoured cruisers, two classes of protected cruisers, about seven classes of unprotected or light cruisers, and six classes of destroyers were scrapped. The total number of ships immediately involved was about 170, but a good many more were implicated as soon as they could be spared from foreign or other service.

From time to time this list has been added to. A notable addition in an Admiralty order dated March 31, 1920, was the original Dreadnought, which in company with the Lord Nelson and other earlier battleships, and submarines E 21, E 25, E 43, and E 52, was ordered to be placed on the list for sale. The Dreadnought had been paid off on August 7, 1918, and since February 25, 1919, had been in reserve commission at Rosyth. Similarly, the first of the battle-cruisers, the Indomitable, launched in 1907 and completed in the following year, was placed on the sale list on April 7, 1920, after being paid off from service in the Nore reserve. On the same date, seven monitors, six cruisers, twenty-nine sloops, twelve paddle minesweepers and patrol vessels, seventeen twin-screw minesweepers, and the tunnel minesweepers Morris Dance and Step Dance were ordered to be sold. On March 3, 1920, nineteen vessels of the "24 Class" sloops, headed by the Ard Patrick, Bend Or, and Cicero, were marked down for sale. Another important addition was dated June 30, 1920, in which there appeared the names of eighty-five more destroyers, of which sixteen belonged to the "H" class, twenty to the "I" class, eleven to the "K" class, nineteen to the "L" class, and nineteen to the "M" class. These vessels were authorised in the years from 1909–10 to 1914–15 inclusive, and some of the "L" class and all the "M" class were only completed after war broke out. Consequently, the entire destroyer arm of the British Navy is now composed of vessels not more than six years old in design and not more than five years old from date of completion. Replying to a question on July 21, 1920, the First Lord of the Admiralty said that the following warships had been sold without restrictions, for the most part to shipbreakers: Fifteen battleships, nine cruisers, seventeen light cruisers, eight monitors, and 141 torpedo-boat destroyers and leaders and torpedo-boats. Warships had been disposed of without payment to British self-governing Dominions as follows: Canada.—One cruiser and two destroyers. Australia.—One flotilla leader, five destroyers, six submarines, and three sloops. New Zealand.—One cruiser. Newfoundland.—One sloop and one trawler.

There remains, then, in the post-war Fleet at the present time the following vessels which may be considered as effective for war purposes: Thirty-one Dreadnought battleships, of which ten carry 15-in. guns, twelve 13·5-in. guns, and nine 12-in. guns; two pre-Dreadnought battleships, Agamemnon and Commonwealth, employed on target and gunnery training duties; eight battle-cruisers, of which three, the Hood, Renown, and Repulse, have 15-in. guns, three 13·5-in. guns, and two 12-in. guns; two light battle-cruisers, with 15-in. guns, the Courageous and Glorious; fifty-eight light cruisers, down to and including the Bristol class of 1909–10; twelve monitors, six with heavy and six with lighter guns; forty patrol boats; varied numbers of sloops and twin-screw minesweepers, still in process of reduction; twenty-seven flotilla leaders; about 240 destroyers, including the later vessels of the "M" type, but excluding all earlier classes not yet disposed of; 100 submarines; and about twenty auxiliary and depot-ships.

Of the above totals, which may be regarded as effective, only a proportion are in commission, as has already been indicated in describing the constitution of the new Fleets and Squadrons. As regards the ten battleships, four battle-cruisers, ten light cruisers, four destroyer flotillas, three submarine flotillas, and attendant vessels, which now form the Atlantic Fleet, it has been officially stated that these constitute the least number of units to ensure progressive tactical and sea training. A lesser number would destroy the possibility of exercises at sea under realistic conditions; the tactical units would be reduced to such an extent that the problems of gunnery concentration, fleet torpedo tactics, destroyer attacks, and anti-submarine tactics could not be studied and practised, and the sea training of officers and men would suffer. As regards the Fleet in the Mediterranean and the squadrons on the China, Africa, North and South America, and East Indies Stations, the need for them, as the First Lord pointed out in his Memorandum, has never been more urgent than it is to-day, in view of the necessity for re-establishing the internal trade of the Empire and promoting that with foreign countries. The Navy constitutes the police of the seas, and all experience teaches that an efficient Navy is the surest guarantee for peace.

REDUCTIONS IN PERSONNEL.

Turning now to the reductions rendered necessary during the last eighteen months in the personnel, the strength of the Navy at the date of the armistice, including the Mercantile Marine Reserve but excluding the Royal Naval Division, was 415,162. Of these, 36,243 were officers and 378,919 men. About 24,000 officers and 235,500 men were serving on engagements expiring at the conclusion of the war. Within twelve months of the armistice—that is, by mid-November, 1919—20,900 officers and 232,000 men had been demobilised under a standardised procedure from all ships and establishments concurrently, which avoided the use of dispersal centres. The repatriation of the Colonial Naval Reserves, amounting to over 2000, and of about the same number of men who had come from abroad to join the Imperial Naval Forces, was effected at a comparatively early stage. The Women's Royal Naval Service, which included 4821 of all ranks at the time of the armistice, was finally demobilised on October 1, 1919. This was the date fixed by the Admiralty by which all men due for demobilisation were to be dispersed, with certain exceptions, for whom special arrangements were made. On March 3, 1920, Dr. Macnamara stated that 700 petty officers and men who were demobilisable were still serving, but the majority were in the Trawler Section of the Royal Naval Reserve, employed in the care of trawlers and drifters reconditioning. This section was finally demobilised on April 30, 1920. The date fixed by which all officers on the retired or emergency lists who had been employed during the war were to revert to their respective lists was November 15, 1919. In exceptional cases, of course, such as on foreign stations, retired or emergency officers continued to serve beyond this date, but their numbers were very few.

The difficulties of bringing down the strength of our naval personnel from a war to a peace standard were materially lessened by the wise policy of Admiralty Boards in recent years of encouraging the various Naval Reserves. The organisation of the latter provided a means whereby the sea service might be easily and quickly expanded in war-time without interfering with the lists of regular officers and men. In the post-war Fleet, however, it was found necessary not only to demobilise all the retired and reserve officers and men, but also to make further reductions in the active service personnel. Proposals for reducing the officers' lists were published on April 1, 1920. They provided for special rates of retired pay, with a gratuity, to lieutenant-commanders over the age of thirty-six, and for a gratuity to lieutenant-commanders and lieutenants under that age, and also sub-lieutenants and midshipmen, who decided to take advantage of this offer and retire voluntarily within six months (or nine months in the case of officers serving abroad) of the promulgation of the order giving full details of the scheme. The First Lord pointed out in his Memorandum that officers of commander's rank and above were already eligible to retire with the half-pay of their rank. Owing to the considerable reduction in the number of vessels maintained in the Fleet, there will be fewer appointments open to officers of this rank, with a corresponding increase in the number of those unemployed, who will necessarily be placed on half-pay. Reductions of the lists of the higher ranks of the Service are being effected automatically by retirements in accordance with the regulations, and the First Lord stated that the adverse effect of the reductions upon the prospects of younger officers is being mitigated by the generous action of distinguished admirals in voluntarily seeking retirement to stimulate the advancement of their juniors.

To reduce the list of midshipmen, the Admiralty on March 24, 1920, published an announcement giving parents or guardians the opportunity of withdrawing their sons or wards from the Navy in order to place them in some other walk of life. If the withdrawal was made on or before September 15, 1920, a withdrawal grant of £400 was made in each case in consideration of any expenses to which parents or guardians had been put in making other arrangements for the future. Applications for withdrawal were dealt with in order of receipt. The withdrawal grant was not paid in cases where a midshipman was liable to discharge under the ordinary regulations for unsatisfactory conduct or incapacity, and the Admiralty reserved the right of withholding permission for withdrawals in cases in which disciplinary action was pending. These arrangements applied only to midshipmen, and were not retrospective; midshipmen of the R.N.R. and R.N.V.R., and paymaster-midshipmen, R.N., were not included.

The position in regard to naval cadets under training at Osborne and Dartmouth was fully set forth in the First Lord's Memorandum of March 15, and also in a notice in the Press on that day, and in circular letters to the parents or guardians concerned. As a result of the end of the war, the Admiralty had so large a surplus in the colleges that it was estimated that in every term passing out between July, 1920, and August, 1922, only about 60 per cent. of the boys then forming those terms could actually go to sea. The Admiralty realised that for these lads they had a special responsibility, in that it was difficult for parents to withdraw them and send them to continue their education at a public school. In many cases the boys were too old for this, and the schools themselves, even if the boys were fitted, could not take them owing to having no vacancies. In order to effect the necessary reduction, the parents of cadets in the terms entered at Osborne between May, 1916, and January, 1919, inclusive, and the "special entry" term of July, 1918, were given the option of voluntarily withdrawing their sons or wards, and in cases where this option was exercised before July 15, 1920, a withdrawal grant of £300 was made in consideration of expenses incurred; but if the parent preferred that his boy should finish his education—one which fits a lad for all walks of life—he was given the option of leaving the boy at the naval establishment. At each final examination, however, 40 per cent. of the boys were not to pass into the Naval Service, and if the numbers of voluntary withdrawals were below this proportion, the remainder of the cadets to be withdrawn were to be selected by the Admiralty at the end of the course at Dartmouth, as a result of the order in which the cadets were then placed. This compulsory reduction was not to apply, however, to the cadets already on board the training cruisers, or to those due to pass out of Dartmouth in April, 1920, in whose case the notice was too short to be given to the parents in fairness. As soon as the reduction of the lists and of the cadets under training has been effected, the following will be the general position: forty cadets will be entered three times a year into Dartmouth College, and fifteen cadets annually by means of the special entry scheme. The last-named, started in 1913, is being continued for a period of four years from July, 1919. Examinations are held annually in June, conjointly with the Army Entrance Examination, and candidates are required to be not more than 18½ nor less than 17½ years of age on July 1 following, as compared with the age of 13½ at which cadets are entered at Osborne. Further particulars of the two systems are given in the extracts from the First Lord's Memorandum in the appendix to this volume. As regards the future prospects of the cadets who stay in the Service and become lieutenants, the First Lord expected that the pre-war percentage of promotions from Lieutenant-Commander to Commander, and from Commander to Captain, would be maintained.

As regards the non-commissioned ranks and ratings of the Royal Navy and Royal Marines, it was decided to effect reductions partly by authorising a limited number of free discharges. An order dated November 13, 1919, stated that any chief petty officers, petty officers, non-commissioned officers, or men over eighteen years of age in ratings other than those in a list given with the order, who desired free discharge, might apply forthwith to their commanding officers. Applications for free discharge were not approved in the cases of writers, victualling and sick berth ratings, electrical artificers, engine-room artificers trained in hydraulics, ordnance artificers, armourer ratings, and masters-at-arms and regulating petty officers. In addition to the grant of free discharges in those grades in which there was a surplus, the Admiralty also resumed, as from July 1, 1920, the system of discharge by purchase. A revised scale of payments introduced in this connection showed that the cost of purchasing a man's discharge had been doubled in most cases, and more than doubled in some.

Before leaving the subject of the post-war reductions in personnel, a word should be said for the admirable work of the Reconstruction Committee under Admiral of the Fleet Sir William May. One direction in which the labours of this Committee were particularly valuable was in regard to openings for naval officers and men in other branches of the public service, or in civil life. Demobilised officers and men, those who joined for hostilities only, had other means of obtaining help in finding employment. Those on whose behalf the Admiralty's interest was more necessary were the long-service personnel, who had gone into the Navy for a career, and who but for the war would have remained in it. From time to time in Admiralty Weekly Orders there were published details of openings under other Government Departments. There was opportunity for a certain number of officers under twenty-eight years of age to enter the Civil Service. Appointments under the Ministry of Labour were given to a few senior officers. The new Transport Ministry and Ministry of Munitions afforded scope for a few more. The Board of Trade allowed certain concessions to cadets withdrawn from the Royal Navy if they wished to enter the Mercantile Marine. For a second mate's certificate, the Board accepted service in the two naval colleges as equivalent to time spent at sea, in the ratio of two months so spent to one month at sea, provided that the total of such service did not count as more than one year at sea. Service in a seagoing training cruiser was accepted in full, and a concession was also made to engineer candidates. A number of midshipmen were also taken as cadets into the Air Force College without examination or fees, apart from the cost of books and instruments. The India Office set a good example in regard to the selection of candidates for vacancies in the Indian Forest Service by stipulating that all candidates must be officers or men who had served in the naval, military, or air forces during the war for not less than one year. A varied and extensive list of appointments under the Colonial Office was published for the information of naval applicants; and, lastly, there were a certain number of openings in the Dominion Naval Forces. In May, 1919, the Canadian naval authorities decided to enter in the military branch of the Royal Canadian Navy only officers who had passed through the naval college of Canada or the ordinary naval training colleges of the Imperial Navy: they refused to transfer any officers of the R.N.R. or R.N.V.R. In the Royal Australian Navy, numerous appointments were notified as being vacant from time to time; and in May, 1920, an invitation was extended to officers and men to volunteer for service under the New Zealand Government in the Naval Forces of that Dominion.

NEW CONSTRUCTION: THE HOOD.

The principal event in regard to naval construction since the last issue of the "Annual" has been the completion of the Hood, which was commissioned on the Clyde for trials on January 7, 1920, and on March 29 was completed to full complement to relieve the Lion as flagship of the Battle-Cruiser Squadron of the Atlantic Fleet. She hoisted the flag of Rear-Admiral Sir Roger Keyes at Portland in May, and on the 29th of that month left on her first cruise to the Baltic. It was explained in the "Annual" for 1919 that the cessation of hostilities interfered with the completion of three of the vessels of the Hood class, the Howe, Rodney, and Anson, work on which was stopped in October, 1918, the contracts being afterwards cancelled. The Hood is therefore the only ship of her type, and is likely to remain so, for as was stated by Rear-Admiral Sir Alfred Chatfield, the Assistant Chief of the Naval Staff, at the Institution of Naval Architects on March 24, 1920, although the Hood was a war product, she was not the product of all our war experience. She was originally designed before the battle of Jutland, and must be judged accordingly.

Sir Eustace d'Eyncourt, who was responsible for the Hood's design, read a paper on the subject at the spring meetings of the 61st Session of the Institution of Naval Architects, from which the following information is largely taken. The Director of Naval Construction said that it was in March, 1916, after considering a number of designs for battle-cruisers, that the Board adopted one for a 32-knot ship of 36,300 tons with armour appropriately equivalent to that of the Tiger. The design had been approved but a few weeks when the battle of Jutland was fought, and as a result it was deemed advisable to increase the armour protection. This was done by accepting a deeper draught and a slightly reduced speed. The alterations were of a radical character, the armour belt being increased from 8 to 12 in., and the barbettes from 9 to 12 in., while certain increases were also made in the deck protection. Sir Eustace d'Eyncourt also said that at the same time the eight 15-in. gun mountings had their design modified to admit of an elevation of 30 degrees, and certain other modifications were made both in the torpedo armament and also in the arrangements for preventing the flash penetrating to the magazines—a form of protection which was elaborated for all our ships at this time. The increases involved an additional weight of nearly 5000 tons, so that the legend displacement of the Hood became finally 41,200 tons when carrying 1200 tons of fuel, the ship then having a draught of 28½ ft. Although her first keel-plate was laid on September 1, 1916, it was not until 1917 that the design was finally approved, and the vessel was launched on August 22, 1918, by Lady Hood, the widow of Rear-Admiral the Hon. Sir Horace Hood, who went down in H.M.S. Invincible at the battle of Jutland.

The outstanding feature of the Hood's design is the blend of the battleship and battle-cruiser types. Since the building of the Dreadnought in 1905–06, the course of British armoured ship construction had taken two distinct directions. There was the battleship, in which weight of metal, combined with good protective qualities, were considered to be the primary factors; and there was the battle-cruiser, in which speed was considered to be of relatively more importance. Thus were built the Dreadnought and Invincible, with 12-in. guns; the Orion and Lion, with 13·5-in. guns; and the Royal Sovereign and Renown, with 15-in. guns. The distinction between battleship and battle-cruiser was clearly defined, although the all-big-gun, one-calibre principle was paramount in both. In the Hood, there has been a fusion of the two designs. "The endeavour," says Sir Eustace d'Eyncourt, "has been in her design to embody the armament and armour protection of a first-class battleship, including also good under-water protection against torpedoes, and at the same time to give her the speed of the fastest battle-cruisers." After explaining that it was only possible to do this by going to a great length and displacement, Sir Eustace made the following comparative survey of recent construction:—

> The under-water bulge protection is additional to anything provided in our pre-war Dreadnoughts, although these ships had internal bulkheads. The addition of the bulge, which has entirely superseded the provision of torpedo netting, involved a considerably increased weight over and above that of a ship of ordinary form; and although this additional weight was accompanied by a somewhat greater amount of additional buoyancy, it still involved an increased displacement with the accompanying increase in resistance to propulsion. It may be argued that in such a large ship a great many eggs are placed in one basket, and that a very expensive one, but it would have been quite impossible to combine the speed, armament, and protection in a smaller unit.
>
> In connection with the size of the Hood and general considerations of design, it is, I think, interesting to note that of recent capital vessels built, and taking the chief characteristics of two classes of about the same displacement, in the Queen Elizabeth we had a well-armoured ship of about 28,000 tons with eight 15-in. guns, and a speed of 25 knots. In the Renown and Repulse, of slightly less displacement, viz. 27,000 tons, though of greater length, we had vessels with 7 knots more speed than the Queen Elizabeth, but with only six 15-in. guns against eight, and approximately about half the armour protection provided in the Queen Elizabeth. In the Hood we are providing the same armament, viz. eight 15-in. guns, as in the Queen Elizabeth, armour protection fully equal to, and in fact rather heavier, in the aggregate, than that of the Queen Elizabeth, 6 knots more speed than the Queen Elizabeth, which makes the speed nearly equal to that of the Renown and Repulse, and in addition a full bulge protection against torpedo attack.

The main armament of the Hood consists of eight 15-in. B.L. guns, as in the Royal Sovereign and Queen Elizabeth types, in four turrets all on the centre line. The heights of the axes of the guns above the normal load water-line for each turret, commencing from forward, are 32 ft., 42 ft., 31 ft. 9 in., and 21 ft. 9 in. The big guns have very large arcs of training, the forward ones to 60 degrees abaft the beam and the after ones to 60 degrees before the beam. The secondary battery consists of twelve 5·5-in. B.L. guns, as compared with fourteen 6-in. guns in the Royal Sovereign, and twelve 6-in. in the Queen Elizabeth and Iron Duke classes. The 5·5-in. gun mounted in the Hood is a new weapon, now adopted for the first time in a capital ship. It is of 50 calibres, with a length of 23 ft.

8½ in., and throws a projectile weighing 82 lbs., the weight of the charge used being 23½ lb. The gun itself weighs 6 tons 4 cwt., and develops a muzzle energy of 4520 foot-tons, with a velocity of 2950 foot-seconds. It will penetrate 4·2 in. of hard steel plate at 5000 yards. These 5·5-in. guns are provided with shields 1 in. thick, and are arranged on the forecastle deck and shelter deck. There are also two 21-in. submerged torpedo tubes, each in a separate compartment forward, and four 21-in. above-water torpedo tubes between the upper and forecastle decks, these above-water tubes being a further addition since the original design was made. Taken altogether, the armament of the Hood appears to have given general satisfaction, although in the discussion upon Sir Eustace d'Eyncourt's paper, Constructor-Commander E. S. Land, U.S.N., said that he would have liked to see a little more protection in the turret tops, while he also thought the gun elevation of 30 degrees might usefully be more. Sir Eustace said he was glad Commander Land liked the turrets; they were expensive articles, and weighing 600 tons were difficult to deal with.

Turning to the armour of the Hood, the increase of the belt and barbette armour to a maximum thickness of 12 in. after the battle of Jutland has already been mentioned. The 12-in. belt has a length of 562 ft., and a depth of 9 ft. 6 in. Above the main belt is a strake of 7-in. armour to the height of the upper deck, and above that again there is 5-in. armour between the upper and forecastle decks. The side armour all slopes outward from below, so that the virtual thicknesses are really somewhat greater, as the shell cannot thus hit the armour normally. Behind all the armour there is thick plating, varying from 2 in. over the greater portion to 1½ in. and 1 in. elsewhere. An improved shape of gun-shields for the turrets has been adopted, with a rather flatter roof. The armour is 15 in. thick in front, and 12 in. and 11 in. on the side, with a thick roof plate.

The torpedo protection consists of the bulge arrangement, with an outer compartment of air and an inner one specially strengthened with the necessary separating bulkheads. Sir Eustace d'Eyncourt has described the arrangement as follows:—

> This protection extends throughout the whole length of the machinery spaces and magazines, and it can be said that it renders the ship as safe against attack from torpedoes under water as she is against gun attack above water. The oil-fuel tanks are arranged along the sides, thus giving additional protection. It is a somewhat curious coincidence that the first series of recent experiments on under-water protection should have begun by a set of trials of torpedo charges against the old Hood, of the old Royal Sovereign class built in 1893. Developing the lessons learnt from these trials, which took place in the years immediately preceding the war, the bulge protection was first designed and fitted at the commencement of the war in the old cruisers of the Edgar type. . . .
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> It may be noted that no ship provided with the original or the later form of bulge was lost, nor even seriously damaged by torpedo attack during the war, nor was there loss of life in any case; this being chiefly due to the special form of bulge and to its being external to the ship proper. By careful attention to the form the reduction in speed is only that due to the added displacement, amounting in the Hood to only a fraction of a knot. Experience and trials have shown that the Hood, as protected, can receive the blows of several torpedoes and still remain in the line without serious loss of speed.

The subject of the bulge was touched upon by most of those who took part in the discussion on Sir Eustace d'Eyncourt's paper at the Institution of Naval Architects. Lord Jellicoe said that the Director of Naval Construction had shown great courage in the adoption of the bulge in the early part of the war, and the Navy owed much to him and to the Constructive Department of the Admiralty for what had been done in connection with it. Referring to models he had seen in the United States of new battle-cruisers with the bulge carried right up to the bows, Lord Jellicoe said he had been told that tank experiments proved this construction to give improved speed as compared with starting the bulge further aft. On this matter, Sir Eustace said that while the carrying of the bulge forward could be done, protection in that part of the ship was not so important. If a forward compartment was broken into, the effect in general would not be so serious. The "Achilles heel" of all ships was often in the neighbourhood of the rudder and propellers, but such positions had usually escaped damage in the war for some reason. As regards the aim of the bulge being to keep a torpedo explosion outside the ship, Sir Phillip Watts, who also spoke, said that if it was sufficient now it would not be sufficient for the larger torpedoes which were already being made. He thought the protection given was not the same as that given by a torpedo net, and suggested that it would be possible to make a rigid shield to be lowered from the ship to deflect or explode a torpedo. To this Sir Eustace d'Eyncourt replied that the advantage of the bulge was that an explosion could take place upwards and outside the ship proper. It saved the integrity of the inner bulkhead. He thought it very desirable to keep an explosion away from the upper works of the ship if possible. It had the great advantage over any form of loose shield, that it was part of the ship and did not demand a lot of care and attention from the officers.

In the matter of her propelling machinery, the Hood presents many interesting features. She is the first capital ship proper to be fitted with small-tube boilers, which were installed successfully in the large light cruisers of the Courageous type. This feature, on account of the smaller space and reduced weight, had the most marked influence on the whole design. With small-tube boilers, about 30 per cent. more power can be obtained with the same weight, and had the type been fitted in the Renown and Repulse, it might almost have been possible to add another turret. The Hood has geared turbines of the Brown-Curtis pattern to develop 144,000 horse-power—the largest power which has ever been put through gearing, viz. 36,000 H.P. on each of the four shafts. At full power the designed speed is 31 knots. The revolutions per minute of the propellers are 210 at full speed, which rate admitted of the adoption of propellers of higher efficiency than many in capital ships before gearing was introduced, when the revolutions were considerably higher.

The official trials of the Hood have been carried out and passed off very satisfactorily. The following results were obtained on the measured mile:—

	Displacement.	Speed (Knots).	S.H.P.	R.P.M.
Legend Load Condition	42,090	13·53	9,110	80
	41,700	15·60	14,630	93
	41,700	17·20	20,050	103
	41,600	20·37	29,080	124
	41,850	25·24	58,020	154
	42,100	27·77	89,010	176
	42,150	29·71	116,150	191
	42,200	32·07	151,280	207
Deep Load Condition	45,000	13·17	8,735	81
	45,000	15·78	14,020	96
	45,000	19·11	24,720	116
	44,600	22·00	40,780	136
	44,600	25·73	69,010	161
	44,600	28·37	112,480	185
	44,600	31·89	150,220	204

At the Legend Displacement 1200 tons oil fuel are carried, and at the Deep Displacement 4000 tons oil fuel are carried.

One other matter which should be mentioned about the Hood has reference to what may be termed the habitability of the ship. Very special attention has been given to the system of ventilation, most of which is by exhaust fans leading direct to the open air. The living spaces are ventilated by trunks supplied by electrically-driven fans, the trunks having openings so arranged that the air is delivered at a low velocity, and strong draughts are thus avoided and a gradual supply of fresh air ensured. In the matter of accommodation, there have been adopted in the Hood practically the whole of the recommendations of the committee which sat just before the war to investigate the question of the accommodation and comfort of officers and men. Recreation rooms are provided, with greater facilities for cooking and similar operations, and, to quote the words of her designer, "in fact, a modern ship is in many respects a home of luxury compared to ships even ten or fifteen years old." The Hood is the first capital ship in the British Navy to possess oil-burning kitchen ranges, so that she has no need of coal for any purpose. It is understood that 1400 dinners can be served in ten minutes from the cook's galley, and the ship's bakery, with its oil-fired furnaces, is capable of producing 1400 lbs. of bread a day.

It is hardly necessary to state that the Hood is the most expensive warship ever built for the British Fleet, costing about six millions. Although enormous, this sum cannot be regarded as excessive when the increase in prices is taken into account, and the displacement and size of the vessel and her qualities are compared with earlier ships. Many of our pre-war capital ships, as Sir Eustace d'Eyncourt has pointed out, complete with their armaments, cost on the average about £90 a ton of displacement. The Hood cost about £145 per ton, or an increase of only 60 per cent. above pre-war prices, although she has qualities possessed by no earlier capital ship.

LIGHT CRUISERS

Progress has been made, although at a slow rate, with the light cruisers, the construction of which was too far advanced for them to be cancelled economically. They belong to three categories. Largest in point of size are the "Elizabethan" class of cruisers for foreign service and commerce protection—the Hawkins, Raleigh, Frobisher, and Effingham. A fifth ship of this group, the Cavendish, was renamed the Vindictive, and completed in October, 1918, as an air-craft carrier. Next there are the two surviving ships of the "E" class, the Enterprise and Emerald, the contract for the Euphrates, ordered from the Fairfield Shipbuilding and Engineering Company, having been cancelled. Thirdly, there are the remaining vessels of the "D" and the "C" classes, the Delhi, Dunedin, Durban, Despatch, and Diomede; and the Cairo, Calcutta, Cape Town, and Colombo. No cruisers of the "C" type could be cancelled after the armistice, as all were too far advanced, the latest order for them being given in July, 1917; but the construction of three of the "D" type was abandoned—the Daedalus, ordered from Messrs. Armstrong Whitworth; the Daring, from Messrs. Beardmore; and the Dryad, from Messrs. Vickers. In the period since the last "Annual" was issued, therefore, work has been performed upon fifteen light cruisers altogether, apart from the four cancelled.

The first ship of the oversea commerce-protecting type, the Hawkins, was commissioned at Chatham, where she was built, on July 24, 1919, by Captain R. G. H. Henderson, C.B., for service as flagship of Vice-Admiral Sir Alexander L. Duff, K.C.B., the newly-appointed Commander-in-Chief in China. The vessel left Devonport on September 6, 1919, for her Station. The next ship, the Raleigh, was launched at the Beardmore yard, Dalmuir, on August 28, 1919, the naming ceremony being performed by Mrs. Eric Long. When completed for service, the Raleigh will become flagship of the Commander-in-Chief on the North American Station, where the flag of Vice-Admiral Sir Trevylyan D. W. Napier, K.C.B., was flown temporarily on shore at Admiralty House, Bermuda, until his death at the end of July by typhoid fever. Thirdly, there is the Frobisher, which was launched at Devonport Dockyard on March 20, 1920, by the Countess Fortescue, wife of the Lord-Lieutenant of Devon, and is now completing afloat. The last of the class is the Effingham, which was laid down at Portsmouth in April, 1917, and which is not yet put afloat.

A general description of the Hawkins class was given in the "Annual" of 1919 (p. 185); supplementing this, it may be mentioned that the cost of these vessels is rather more than was anticipated. A sum of about £750,000, exclusive of guns and mountings, was estimated when the class was proposed early in the war; actually, including £41,200 for guns and £93,775 for gun-mountings and torpedo tubes, the total cost of the Hawkins, as revised, was £1,591,864. As regards protection, the deck plating and aft bulkheads are of 1-in. thickness, and there is 3-in. armour on the conning tower and 2-in. on the communication tube. On the sides of the ship, including the thickness of the hull plating, the protection is 3 in. and 2 in. amidships, 2½ in. and 1½ in. forward, and 2½ in. and 1½ in. aft. In transverse section, the sides of the vessel slope inwards from the forecastle deck right down to the bottom plating, where they meet the lower edge of the bulge. The latter extends upwards nearly to the load water-line, and although it projects for a maximum of 5 ft. from the ship's side, yet the breadth of the ship over her bulges is no greater than the extreme beam at the forecastle deck. The form of construction, moreover, gives great strength of girder in the longitudinal direction, and the outward flare obtained from the sloping sides above the load water-line adds to the protective value of the side plating by increasing the angle of impact of falling shell.

The advent of this quartette of fast light cruisers with 7·5-in. guns marks an interesting stage in cruiser development. They are at present unmatched in any navy, for in all other fleets 6 in is the limit of the calibre of the guns installed in cruisers. In respect of gun-power, the Hawkins and her sisters represent as great an advance over all other light cruiser types as the 6-in. gunned British cruisers did over 4-in. German vessels at the outbreak of war. Grand Admiral von Tirpitz, in his memoirs, admits that in the North Sea the superior armament of the British light cruisers was demonstrated over and over again. He refers to the reproach that the German ships were too lightly armed, and says that in 1912 he resolved to institute a change in the calibre of their vessels, as he felt bound to pass at once from a 4-in. to a 6-in. gun as a minimum calibre, as sufficient armour-piercing power could not be obtained with less calibre.

Dealing next with the Enterprise and Emerald, it may be observed that although, in point of size, these are smaller vessels than the class just described, they are later in regard to age, as it was not until the beginning of 1918 that their design was sanctioned. While the Hawkins and her sisters are therefore the outcome of war experience so far as it relates to overseas commerce protection, the Enterprise represents the latest development of light cruiser design for ordinary service. The following table brings into comparison the salient features of both classes and those immediately preceding them :—

Name.	Date of Design.	Displacement, Tons.	S.H.P.	Speed, Knots.	Guns.
Chatham .	1910	5400	25,000	25·5	Eight 6-in.
Arethusa .	1912	3510	40,000	30	Two 6-in., six 4-in.
Calliope . .	1913	3750	40,000	30	Two 6-in., eight 4-in.
Centaur . .	1914	3750	40,000	30	Five 6-in.
Hawkins .	1915	9750	60,000	30	Seven 7·5-in.
Danae . .	1916	4750	40,000	29	Six 6-in.
Enterprise .	1918	7550	80,000	32·5	Seven 6-in.

The special requirements which the "E" class were designed to fulfil were (1) To enable the vessels to obtain the high speed possessed by the fast German light cruisers then known or likely to be built or building; and (2) To adopt a new arrangement of 6-in. guns recommended by the Fleet officers as a result of war experience with the more recent light cruisers. A speed of thirty-two knots in the full-load condition, with thirty-three knots in the light condition, was approved, and in order to obtain this rate economically a greater length of ship was required than for earlier types. Other requirements from the Fleet which involved additional air spaces also necessitated an addition to the length, and finally the measurement between perpendiculars was fixed at 535 ft., and overall, 570 ft., as compared with 445 ft. and 471 ft. in the "D" class, and 420 ft. and 446 ft. respectively in the "C" class. Experience at sea with earlier cruisers led to the new vessels being given increased freeboard forward all along the forecastle, instead of rising at the stem only, and this is expected to assist materially in keeping the vessels dry even in heavy weather. Their beam of 54½ ft. is 8½ ft. more than that of the Danae and 13 ft. more than in the Calliope. The mean draught at load water-line (with 3-ft. trim by the stern) is 16½ ft. It is interesting to observe that the legend displacement of 7550 tons is approximately that of the Edgar class of second-class protected cruisers designed about thirty years earlier, but the latter were much shorter, broader, and deeper vessels. They were 360 ft. long by 60 ft. beam and had a draught of 23¾ ft., the length of the Enterprise being nearly 50 per cent. greater.

The propelling machinery virtually consists of a double set of engines such as were provided in the flotilla leaders of the Shakespeare class, the four shafts being driven by geared turbines, those for the wing shafts being accommodated in the forward engine-room and those for the inner shafts in the after engine-room. The total S.H.P. thus obtained, 80,000, is greater than that of any battleship in the world's navies at the present time, and is only exceeded by the later battle-cruisers of Great Britain, America, and Japan, and by the light cruisers which America has building. The boilers are eight in number, arranged in four boiler-rooms, three of which are situated before the magazines for the midship guns, while the fourth boiler-room is abaft the forward engine-room. The foremost and aftermost boiler-rooms are generally similar in arrangement, each having a boiler at each end of the space on the middle line, with longitudinal oil bunkers on either side. The disposition of the boilers in the two centre boiler-rooms is such that the uptakes from all four boilers in them lead into one large funnel, whereas separate funnels are provided for Nos. 1 and 4 boiler-rooms. The profile of the ship is thus curious for the uneven spacing of the three funnels.

In regard to protection, this follows previous light cruiser practice. There is side protective plating, making, with the skin plating, a total thickness of 3 in. abreast the machinery spaces and amidships magazines. This plating extends from the upper deck edge to 2½ ft. below the load water-line, giving protection from the stem to near the rudder head, but it is less in depth at the ends than amidships. The total thickness abreast the forward and after magazines and oil-fuel tanks is about 2½ in., tapering to 1½ in. forward and 2 in. aft. There is a 1-in. bulkhead at the stern end of the after engine-room. Over the last-named—an improvement on previous ships—is fitted protective deck plating of 1-in. thickness. There is similar plating over the steering gear and magazines, and ½-in. protective plating is fitted at the sides and ends of the magazines for a depth of 3 ft. from the crowns of the magazines. An important feature of the design is the complete separation into two parts (longitudinally) of the engine-rooms and boiler-rooms. A boiler-room and a magazine space is placed between the two engine-rooms, while another magazine space is placed between the forward engine-room and No. 3 boiler-room. This arrangement increases the security of the machinery and provides additional protection to the foremost and aftermost boiler-rooms, which have oil bunkers on either side. The "E" class have no bulges or "blisters." Bulge protection of the modified type adopted for the Raleigh class could only have been provided at the expense of speed unless the dimensions were increased considerably, but the advantages resulting from the separation of the machinery compartments is considered to be almost equivalent to those obtained by a modified type of bulge.

The advance in armament over the vessels of the "D" class is represented by an additional 6-in. B.L. gun, of which seven instead of six are mounted, and by the adoption of two 4-in. instead of two 3-in. high-angle guns for use against aircraft. The torpedo armament, consisting of four triple deck revolving torpedo tubes, is the same in both types. The arrangement of the 6-in. guns provides for two forward and two aft, as in the "D" class, the second guns from either end firing over the first. A fifth gun is fitted abaft amidships, on the middle line, at the forecastle deck level, while the remaining pair are placed at about midships, one on each side of the forecastle deck abreast each other, having a large arc of fire.

The Enterprise and Emerald are building respectively by Messrs. John Brown and Co., Clydebank, and Messrs. Armstrong, Whitworth and Co., High Walker, from whom they were ordered in March, 1918. The machinery of the former will be supplied by the contractors for the hull; that for the Emerald by the Wallsend Slipway and Engineering Co., Ltd. The Enterprise was launched on December 23, 1919, by Lady Maclay, wife of the Shipping Controller, and on April 12, 1920, she arrived at Devonport to be completed for service at that dockyard. The Emerald was launched on May 19, 1920, by Lady Craig, wife of the new Parliamentary Secretary of the Admiralty, and in October was taken to Chatham Dockyard for completion. This vessel was the last fighting ship of the war programmes to be put afloat in the private yards.

THE D CLASS OF CRUISERS.

A brief description of this type—the Delhi, Dunedin, Durban, Despatch, and Diomede—was given in last year's "Annual," where it was mentioned that the original three ships, the Danae, Dauntless, and Dragon, had been ordered in September, 1916, and finished just before the armistice. The Dauntless and Dragon escorted the Renown on her voyage to Canada with the Prince of Wales. Particulars published in November, 1919, by the builders respecting the trials of the Dragon, which took place in the Firth of Clyde, show these to have been very successful. The Dragon, built by the Scotts' Company at Greenock, is propelled by Brown-Curtis geared turbines driving twin-screws. Steam is supplied at 235 lb. per square inch by six water-tube boilers of the Yarrow type; two in the forward stokehold and four in the after stokehold. Arranged in tandem with the high-pressure turbine is a cruising turbine, which may be connected be means of a clutch to the high-pressure rotor, and is used when the total S.H.P. does not exceed 6000, corresponding to a speed of about eighteen knots. On the progressive speed trial of the Dragon, a shaft horse-power of 41,960 was recorded, with the propellers running at 270 revolutions per minute. The steam pressure at the high-pressure turbine nozzles was 206 lb. per square inch, and the vacuum in the condensers was 28¼ in. Of the five additional ships of the class, the first three were ordered in July, 1917, and the Despatch and Diomede in March, 1918. As compared with the later "C" cruisers, one more 6-in. gun (six instead of five) was mounted, and there was an increase in the torpedo armament, but although a bigger hull was necessary, and the displacement advanced from 4190 to 4750 tons, the additional length of 20 ft., and the reduction of the revolutions from 290 to 275, enabled the speed of approximately thirty knots to be maintained. The type of machinery favoured was the twin-screw geared arrangement which had been so successful in the Champion. On her official trial the Delhi, with a shaft horse-power of 40,530 and 261 revolutions per minute, made a mean speed on the measured course of 28·47 knots, the displacement being 4960 tons.

The Delhi was commissioned for service on May 31, 1919, and became the flagship of Rear-Admiral Sir Walter Cowan in the Baltic. The Dunedin, commissioned on September 13, 1919, in the Tyne, also joined the First Light Cruiser Squadron under this officer. The Durban was launched on May 29, 1919, from the Scotts' Shipbuilding and Engineering Company's yard at Greenock, when Mrs. Louis Botha, the wife of the South African Premier, performed the naming ceremony. The vessel was towed to Devonport Dockyard some six months later for completion. The Diomede took the water from the yard of Messrs. Vickers at Barrow on April 29, 1919, and in her case Lady Doreen Long, the wife of Mr. Walter Long, First Lord of the Admiralty, performed the naming ceremony.

There was a curious outcome of the first attempt to launch the Despatch on September 10, 1919, a hitch occurring which caused the vessel to remain fast on the ways. The company present, including Mr. Long, waited for an hour while efforts were made to move the vessel, but after two tugs had endeavoured to tow her off, during which two ropes snapped, the launch was abandoned. The vessel was eventually put afloat on September 24. On December 27, 1919, she left the Clyde in tow of tugs for Chatham Dockyard to be completed.

Since the last issue of the "Annual," work has been performed on the last four cruisers of the "C" type, described on pages 182-4 of the 1919 edition. The final group of the "C" cruisers included five vessels, of which the Carlisle was commissioned in November, 1918, and a few months later went out to China. The Calcutta was commissioned in March, the Colombo in July, and the Cairo in October, 1919, the first-named being allocated as flagship of Rear-Admiral Sir Allan Everett, commanding the Eighth Light Cruiser Squadron in the West Indies. Only one of the group has been launched during the period under review, the Cape Town. This vessel took the water at the south yard of Messrs. Cammell Laird and Co., at Birkenhead, on June 28, 1919, and six months later was towed to Pembroke Dockyard for completion. The naming ceremony at the launch was performed by the Hon. Mrs. Walter Long, daughter-in-law of the first Lord. The Cape Town was the last of an interesting series of cruisers turned out at Birkenhead during the war, the first of which, the Caroline, was fully completed in ten months from the laying of the keel, for which achievement the firm was specially thanked by the Admiralty. Others were the Castor, Constance, and Cairo, and there were also the ex-Greek cruisers Birkenhead and Chester. The machinery of the Cape Town is of the twin-screw single-geared turbine type, each engine being composed of one set of Parsons' compound turbines driving the propeller shaft through the main gearing. A cruising turbine is also fitted on one side of the vessel and geared on to the H.P. turbine shaft for economical running at low speeds. The boilers are of the Cammell Laird water-tube type fitted for burning oil fuel. The whole of the vessel's machinery, with the exception of the auxiliaries, has been manufactured at the Birkenhead works, and all the turbine forgings and shafting were made at the works of the firm at Sheffield.

The following results were attained at the official trials of the Colombo:—

Displacement (Mean on Trial).	Speed (Knots) (Mean on Measured Course).	S.H.P.	R.P.M.
4267	15·27	3,621	150
4263	18·36	6,213	181
4241	20·27	8,347	200
4270	22·91	12,044	227
4233	24·86	16,050	248
4263	26·91	24,050	279
4187	29·48	40,650	328

DESTROYERS, SUBMARINES, AND MISCELLANEOUS CRAFT.

There were, of course, no developments during the year in regard to destroyer or submarine construction, the boats upon which work was continued being those of old programmes which were fully dealt with in the "Annual" for 1919. The vessels launched included the

Wivern and Wolverine, at Messrs. White's, East Cowes, on April 16 and July 17, 1919; the Whitehall, by Messrs. Swan Hunter, in September, 1919; and the Thracian, by Hawthorn, Leslie, and Co., on March 5, 1920. The launch by Messrs. Yarrow and Co. of the Tyrian on July 2, 1919, was interesting as being the first warship launch since the signing of the peace treaty. This vessel, some five months later, was reported to have achieved a world's record on her trials, by making a speed of close upon forty knots. Only a few months previously, the Turquoise, a sister-ship, built by the same firm, had maintained on her official trials the remarkable speed of 39·6 knots. The Tyrian's speed was achieved on an Admiralty four-hours' official trial, and the builders were of opinion that had the vessel been run in shallow water a still higher speed would have been obtained.

There were in hand at the time of the armistice eleven flotilla leaders, ninety-seven destroyers, and seventy-three submarines, of which four flotilla leaders, forty destroyers, and thirty-three submarines were subsequently cancelled. Work was stopped upon two flotilla leaders in November, 1918, and the other two in March, 1919. Of the destroyers, work ceased upon eighteen in November, 1918, fifteen in March, 1919, and seven in August, 1919. Of submarines, eleven were stopped in November, 1918, seventeen in March, 1919, and five in August, 1919. The Navy Estimates, dated March 4, 1920, showed that only two flotilla leaders, eight destroyers, and thirteen submarines then remained to be completed out of the seven flotilla leaders, fifty-seven destroyers, and forty submarines, the construction of which was continued. Several of these have since been passed into service. Of the large number of auxiliary craft in hand when hostilities ended, a good proportion have been converted for other purposes, or for commercial and private use. There were, for instance, ninety-nine twin-screw minesweepers in hand, of which thirty-six were cancelled, and six out of the remainder were completed as surveying vessels. These are the Beaufort, Collinson, Crozier, Fitzroy, Flinders, and Kellet, and at the present time they form the majority of the ships in the Surveying Service of the British Navy. Of 259 trawlers building at the armistice, eighty-two were cancelled altogether, and 133 were cancelled for the Navy but completed for mercantile use; while of 206 drifters building, sixty-four were cancelled altogether, and 109 cancelled for the Navy but completed for mercantile use. There are no more vessels of either class in hand. On March 24, 1920, it was officially announced that, in accordance with the decision of the Cabinet, arrangements were being made to turn over surplus Admiralty drifters, adapted for fishing, to the Fishery Boards for disposal. In addition, a scheme was inaugurated by which 200 trawlers were transferred to the Ex-Service Fishermen's Co-Operative Trawling Society.

MERCHANT SHIPBUILDING IN THE ROYAL DOCKYARDS.

The question of the utilisation of the Royal Dockyards for merchant shipbuilding caused a good deal of discussion during the year, and the Government appointed a Committee under the chairmanship of Lord Colwyn to consider the subject. This Committee recommended that the Admiralty should utilise their surplus facilities in the construction of mercantile vessels, if the matter was taken up wholeheartedly and as the main object of the dockyards. "The concentration on these vessels by the building yards," the report continued, "would release repair and reconditioning work to keep the other dockyards in employment. We do not regard this as a permanent solution of the difficulty, nor recommend that this should be carried on indefinitely. . . . But we consider that this proposal offers to the Admiralty an expedient for tiding over a difficult period of distress, and the Committee hope and expect that in the present position of the shipping trade the Admiralty will be able to build without any loss." The four main points in the report were:—

1. That the Admiralty should use the surplus facilities at its dockyards in the construction of mercantile vessels; and that labour should have a voice in the management of the work.
2. That the dockyards should not be leased to private owners, because such a scheme has no chance of commercial success, as dual control of essentials would be unworkable, and priority could not be allowed to a commercial firm.
3. That the dockyards should not be used for the manufacture of trade articles.
4. That Devonport is suitable as a terminal port for shipping lines, and that shipowners should be invited to make use of this port.

As regards (2), the Admiralty had already received from the Forth Shipbuilding Company an offer for a thirty-years' lease of Pembroke Dockyard, and inquiries were made locally as to what proportion of the established workmen would be prepared to remain and enter the service of the firm in the event of acceptance. In a "Note on Dockyard Policy" appended to his Memorandum of March 12, 1920, however, the First Lord intimated that it had been decided, in view of the difficulties of the present situation, not to proceed further with the proposal. On the general question of mercantile shipbuilding, Mr. Long pointed out that while the number of men employed on shipbuilding and repair work had increased from 42,000 before the war to 67,800 at the armistice, the increase was mostly in the engineering trades and in semi-skilled and unskilled labour, and these classes were necessarily out of proportion to the numbers of shipwrights and allied trades. The policy of the Board in getting back to a normal peace establishment has been to effect the necessary reduction in numbers as gradually as possible by a system of regular weekly discharges, preceded by a fortnight's notice, so as to enable men to get employment in the merchant shipbuilding yards, where the need for additional labour was stated to be urgent. Experience soon showed, however, that these yards only absorbed a small number of the men so discharged, owing largely to the impossibility of finding married accommodation in the commercial shipbuilding centres, but also to the fact that the surplus dockyard men belonged chiefly to the engineering trades and the urgent demand in the merchant yards was for shipwrights and allied trades. Considerable numbers of shipwrights who could ill be spared from the dockyards were set free in the autumn so as to relieve the shortage in the merchant shipbuilding yards. This was no doubt welcomed by the latter, for, as the Chairman of the Fairfield Company said at the launch of the Despatch, in September, 1919, that firm alone could employ 4000 additional men if shipwrights were released from the public yards; but the result was still further to disarrange the proper balance of trades in the dockyards and create more difficulties in the way of their undertaking merchant construction.

In March, the Admiralty took steps to lay down at Devonport a 10,000-ton oil tank vessel for naval use, and the keel-plate of this ship was laid immediately after the launch of the Frobisher on March 20, 1920. Provisionally, the vessel is known as merchant ship ①. A similar vessel, known as ②, was ordered from Pembroke Dockyard, but to accommodate her the building slip, previously used for light cruisers, had to be broadened and lengthened, the cost of the alterations being estimated at £10,000. As regards Chatham, a slip was available, but the urgent naval repair work there employing shipwrights was so large, and the disproportion of trades so great, that a merchant vessel could not be started without drawing away shipwrights from the commercial yards. In April, the Admiralty ordered discharges to proceed at the rate of forty-five a week, spread over the several departments and trades, but stated that it was "hoped to make provision for merchant ship construction when strictly naval requirements had been met." Discharges at Portsmouth at this time were fixed at thirty-five a week, exclusive of ordinary wastage; thirty-five a week at Devonport; and ten a week at Pembroke and Sheerness. It was announced in May that the Admiralty had decided to build a third 10,000-ton oil tanker at Portsmouth, with a proportion of the vessel's machinery, together with some machinery for the other two oilers already mentioned. Chatham was to manufacture certain machinery for these oilers, and Sheerness was to provide a floating dock for seaplanes, and machinery for oilers.

In addition to the foregoing, two vessels are at present building at Devonport dockyard for private owners. These are a "C" type standard steamer of 5150 tons dead weight, to the order of Messrs. J. and H. Maxwell Jones, of Plymouth; and a small collier, to the order of the Plymouth Co-Operative Society. Messrs. Jones, in October, 1919, also offered to place an order for a coasting steamer of 750 to 1000 tons dead weight, and a steam trawler, but were informed by the Admiralty that if it were possible at a later date to undertake more merchant shipbuilding at Devonport, their offer would receive further consideration. Messrs. Cayzer Irvine and Co. offered in November, 1919, to order the construction of two merchant steamers, but the Admiralty were not then in a position to undertake the work. A Swansea shipowner in February, 1920, also offered to order two hulls of ships about 200–270 feet long for which machinery was available, but this was not acceptable as machinery work was wanted in the dockyards as well as hull work. There were also offers, which could not be accepted, from the Cunard Company to recondition the Caronia and Saxonia.

PERSONNEL.

Turning now to the important questions affecting Personnel, the steps taken towards demobilisation have already been explained, and in continuation of the chapter on administration and personnel by Mr. John Leyland in the last issue of the "Annual," there remain to be dealt with the later measures which were necessary in connection with the reorganisation of the smaller forces needed for the post-war Navy. The policy which has been followed in regard to these matters was explained in the First Lord's Memorandum for 1920–21, and it covered such questions as entry and training; pay, pensions, and allowances; promotion and prospects; uniform, clothing, and victualling; reorganisation of the civil branches; naval reserves; and general questions of welfare. The First Lord's "Notes on Naval Policy" will be found reproduced in full in the appendix.

SYSTEM OF ENTRY FOR NAVAL OFFICERS.

In the matter of the system of entry for naval officers, and their early education, it will be seen from the First Lord's statement that the principle of common entry is still adhered to. Engineer and deck officers alike join the same college at the same age, and receive identical training up to the moment when the former have to specialise. Osborne Naval College is being closed down as there is sufficient accommodation at Dartmouth for the reduced number of cadets, but owing to the difficulties of housing for the staff at Dartmouth, the decision will not take effect until the spring of 1921. The last cadets will therefore leave Osborne at the end of the next Easter term. Concurrently with the common entry system, entries from the public schools are being continued for the present. It may be of interest to mention that from the institution of the special entry scheme in 1913, up to February, 1919, 1072 candidates appeared before the interview committees, of whom 408 came from the bigger public schools, 631 from the lesser public schools and grammar schools, twelve from council schools, and twenty one from the lower deck of the Navy. Under the regulations of the special entry examination, there is nothing to prevent a young man from the lower deck between the ages of 17½ and 18½ from sitting for this examination, and if successful, he becomes one of the special entry cadets in the ordinary course of events. But owing to the lack of early educational facilities, and also to the specialised training received since joining the Naval Service as boys, to the detriment of their education in such examination subjects as French and Latin, it has been found that, in spite of official encouragement and help, only a small percentage of men can possibly succeed in obtaining commissions by the special entry system. This is one reason why the Admiralty has improved the facilities for energetic and industrious lads to become lieutenants by means of the "Mate" system, to be referred to later.

UNIVERSITY TRAINING FOR NAVAL OFFICERS.

A new feature in what may be called the higher education of naval officers since the war is the introduction of a course of University training. Reviewed in the light of war experience, it appeared to the Board that the former system gave a type of officer of high professional attainments, but one whose training was too strictly professional and technical, placing him at a disadvantage as compared with his contemporaries in other walks of life. A course at Cambridge was decided upon for those younger officers whose general education at Osborne and Dartmouth was interrupted by the war, but it will not be until 1922 that all the officers whose studies were thus interrupted will have been through this course. Meanwhile, as the First Lord has explained, the Admiralty, convinced of the enormous benefit of a University course to the officers concerned, in broadening their outlook on life and bringing them at an impressionable age into contact with University thought and ideas, have in contemplation a scheme, subject to the concurrence of the University authorities, under which in the future a University Course will be an integral part of training for about 25 per cent. of the sub-lieutenants in each year.

COMMON ENTRY SYSTEM AND ENGINEERS' TRAINING.

An important stage has been reached during the past year in the progress of the common entry system, inaugurated in 1903, the first officers entered under it having reached the rank of lieutenant-commander. These are Lieutenant-Commanders Oliver Bevir and Kenneth Edwards, D.S.C., who were promoted on February 15, 1920. It may be of interest to recall that the number of candidates interviewed for this original term of entry at Osborne in August, 1903, was 278. Of this total, seventy-five were selected and joined the college at Osborne, sixty-four of whom passed on to Dartmouth in September, 1905. The number who passed out of the Cumberland and were rated midshipmen in May, 1908, was fifty-six, of whom fifty-four presented themselves for examination for lieutenant three years later. After this, the war came, and in February, 1920, the number remaining on the active list who were due for advancement to lieutenant-commander was thirty-five.

The whole subject of the future training of engineer officers in the Navy, including the question of early specialisation and the devotion of increased time to engineering subjects, has received the attention of the new Board of Admiralty. In an order dated February 21, the Board decided that, for the present, midshipmen after one year's service at sea were to be permitted to volunteer for (E) duties. For those not volunteering for engineering, only one-eighth of their time was to be devoted to this subject. They were to devote two-thirds of their time to the deck, seamanship, navigation, and pilotage, five-twenty-fourths of the time to gunnery and torpedo, and one-eighth to engineering. Midshipmen not volunteering for engineering were, when undergoing engine-room training, not to be considered as available for engine-room duties during action stations; on the other hand, those volunteering for engineering were not to be considered as available for deck action stations but included as members of the engine-room staff. It had previously been decided, in October, 1919, that the examination in engineering and the certificate of engine-room watch-keeping, were to be voluntary for those midshipmen who did not volunteer for (E) specialists. Consequently, such midshipmen are not now required to undergo the fourth month's course of engineering training laid down in Article 959, clause 4, of the King's Regulations.

The position in regard to military command of the officers who had already specialised as lieutenants (E), or were under training for it, was reviewed by the Admiralty in March, 1920, and three choices were offered in connection with the revised regulations in monthly order No. 4047 of 1918. The first was for these officers to remain as they were, in which case they could not expect to receive engineering appointments continuously, but would have to take their turn in deck appointments, when they would drop any specialist allowance for (E) duties they might otherwise have received. They would also have to be judged for promotion to commander and captain in competition with deck officers generally and not on their engineering abilities, as would be the case if they accepted the new scheme and did not revert to deck duties at from 7½ to 9 years' seniority as lieutenants. The second alternative was to accept the application to them of the new regulations, and forego all future right of reversion to deck duties and military command. The third choice was to revert to deck duties forthwith. From lists published in Admiralty Orders on February 18, 1920, it appeared that there were two lieutenants (E) who elected to remain under the old regulations, devoting themselves to engineering, with the option that in special circumstances they might be permitted to drop it and revert to deck duties on promotion to commander. A further six officers elected to retain the right of military command and the option of reverting to deck duties on attaining between 7½ and nine years as lieutenants, foregoing this right if they qualified for an (E†) course. In the second category there were eighty-eight officers who decided to forego all future right of reversion to deck duties and military command. Under the third category, no officer chose to revert from engineering to deck duties forthwith.

The emphatic preference thus expressed no doubt influenced the Board in the decision they took in July to make separation between the engineering and deck branches final and complete—so far, of course, as service after the period of specialisation is concerned. It was stated in Admiralty Orders of July 17 that—

> Separation being accepted, the prospects of each branch should be such as to maintain high efficiency in the personnel composing the branch. So far as the deck side is concerned, this is allowed for by the prospects of high command opened up to all who enter that side of the profession, but on the engineering side it cannot be said that this is fully the case, and with the exception of the office of the Engineer-in-Chief, and certain technical appointments, there are comparatively few higher posts. There is a danger, therefore, that under existing conditions the engineering side may fail to attract its due proportion of officers of ability, and the Service will suffer in efficiency accordingly.

The Board accordingly decided that the office of Engineer-in-Chief should be given extended scope. Instead of being entirely under the Controller, with responsibility only for design and supply of machinery, he will in future be responsible to the Chief of the Naval Staff for advice on all matters connected with engineering policy, and will be the principal adviser of the Board upon all questions relating to the instruction and training of the engineering personnel. The Admiralty further decided that for the posts of Admirals-Superintendent at the Dockyards, officers of the common entry or special entry systems who have joined the engineering branch shall be eligible, as soon as they have attained the necessary rank. Should the Admiral-Superintendent be an engineer officer, the principle will continue that he will not be eligible to command the port, since such command in time of war deals with operations, the province of the deck officer. Doubtless with a view to providing them with training and experience, two officers of the first group of engineering specialists, after passing through the (E†) course at Greenwich, were on August 1, 1920, appointed to Portsmouth and Rosyth Dockyards to assist the Engineer Managers and to take charge of the Drawing Offices at these yards.

SPECIAL COURSES FOR OFFICERS.

Other changes made since the last issue of the "Annual" affecting the education and training of naval officers may be briefly summarised. Four distinct courses of instruction open to officers of the deck branch are now in progress—the Staff Course at Greenwich, of which the Director is Captain the Hon. Reginald A. R. Plunkett-Ernle-Erle-Drax, D.S.O.; the Senior Officers' War Course at Greenwich, of which the President is Rear-Admiral H. W. Richmond; the Intelligence Course at Greenwich, under the direction of Major Charles B. Mullins, R.M.L.I., who has the title of "Instructor in Intelligence Duties"; and the Senior Officers' Technical Course, at Portsmouth, which now consists of three weeks in the Excellent, three in the Vernon, and one each in the Navigation and Signal Schools. The Naval Staff College at Greenwich was opened on June 5, 1919. It is solely an instructional establishment engaged in training officers for War Staff duties. It has no planning, executive, or administrative functions, nor is it responsible for advice to the Board on any matters. The Director of the College works under the general superintendence of the Director of Training and Staff Duties at the Admiralty. The course lasts about twelve months. The Senior Officers' War Course, held before the war at the Royal Naval College at Portsmouth, was resumed at Greenwich, on March 1, 1920, the number of officers in the first course being twenty, without any commanders. The Senior Officers' Technical Course was revived on August 9, 1920, when about twenty-two captains, R.N., were appointed for it. The Admiralty announced that this course in some respects constitutes a preparation for the War Course, and, as a general rule, officers taking the latter should have been through the Technical Course within the previous six months. They should therefore apply for both Courses, which will in future be arranged to run consecutively. The Intelligence Course is a branch of the Staff College training, and was started during the war. It lasts about seven weeks. For the course at the Senior Officers' School at Woking, beginning on September 24, 1920, the Army Council allotted two vacancies to the Admiralty, who decided to send two captains, R.N., who had not yet held a command afloat.

PAY AND PROMOTION.

Questions concerning pay were mostly all settled by the Jerram and Halsey Committees, whose reports were published in 1919. It should be added that the children's allowance to married naval officers was withdrawn on December 31, 1919, and nothing has taken its place. The separation allowance to the seamen was abolished on September 30, 1920, and from the first pay day in October a marriage allowance came into force instead. On March 31 and May 31, 1920, the various concessions to officers and men in regard to railway travelling which were granted during the war came to an end. Free warrants for annual or sick leave, or for men visiting home on account of the serious illness of a parent, wife, or child, were withdrawn; as were concession vouchers for reduced rate travelling to the wives and children of officers and men. The Admiralty on June 26, 1920, issued new orders extending the payment of an allowance to officers living on shore, without the services or partial services of a servant, to all ranks from warrant officers upwards. Previously, servants' allowance was only granted to the captains of a few stationary ships and shore establishments at home, and, at Admiralty discretion, to captains holding appointments entitling them to two servants.

Under the head of promotion, an important step taken during the past year has been the fixing of an upper limit to the zone of promotion to captain and commander. On April 21, 1920, the Admiralty stated that as there appeared to be a certain amount of doubt with regard to their prospects of promotion among senior commanders and lieutenant-commanders, it was considered desirable to make it clear that officers who had passed the upper limits would not be promoted unless for exceptional services. These limits were fixed, for commanders, at eight years' seniority; and for lieutenant-commanders, at six and a half years. As regards the engineering branch, promotions to engineer-commander will in future be made in a similar manner to those to commander, viz. by selection in half-yearly batches in June and December; the first selection was made in June, 1920. It has also been decided by the Admiralty that the policy of selection, already provided for in the regulations and Orders in Council, would be more strictly exercised in regard to promotions to the ranks of Engineer-Captain, Surgeon-Captain, and Paymaster-Captain. Vacancies arising up to and including January 1, 1920, were filled as they occurred, but subsequent promotions are being made half-yearly only, on June 30 and

December 31, and Commanders-in-Chief are directed to forward recommendations by May 15 and November 15 in each year.

An important improvement in the "Mate system," whereby selected petty officers, provided they had seven years' service, have been given commissions as Mates, and, after a series of examinations and further service of two years, been made Lieutenants, was announced in the First Lord's Memorandum. The seven years' rule is now abolished. A man on reaching the age of twenty-one, provided he has satisfied the requirements of a Sea Selection Board and has passed the seamanship examination for officer's rank, and has further taken a first-class certificate in the special educational test, embracing mechanics, geometry, history, physics, and general subjects, will be eligible for selection before an Admiralty Selection Board, and those selected to fill the vacancies available will become Acting Mates, the earliest age being twenty-one. Provided a man takes a first-class certificate in the further special courses he will undergo, he can become a Lieutenant at twenty-three, instead of at twenty-eight or twenty-nine as hitherto, and will thus reach the rank at about the same age as a special entry cadet.

As regards the prospects of officers in general, it was announced on July 3, 1920, that a certain number of those who had completed their examinations for lieutenant, and had been granted watch-keeping certificates, could be seconded to the Royal Air Force for a period of three years, the majority of this period to be spent upon naval air work and with the Royal Navy. Officers so loaned will be graded as flying officers on joining, but if they hold rank in the Navy higher than sub-lieutenant they will be granted honorary rank in the Royal Air Force equivalent to their naval rank. They will carry the rank, pay, and authority of their substantive Air Force grading for all Air Force purposes, and will wear the Service dress of the R.A.F., but the full dress and mess dress of their parent Service. Another important decision in July was the establishment of a separate supernumerary list of Royal Marine officers for those employed on wireless duties.

UNIFORM, CLOTHING, AND VICTUALLING.

Changes under the fourth heading mentioned—uniform, clothing, and victualling—were made both as regards officers and men. It was decided in August, 1919, and approved by the King, that Dress No. 1 for officers (full dress) will in future be worn only at His Majesty's Levees at home; on all other occasions of ceremony for which No. 1 dress is prescribed, No. 3 dress (frock coat with epaulettes) is to be worn in lieu. The undress tail coat is no longer compulsory, the mess jacket with epaulettes being worn instead. Other alterations of detail have been made with a view of simplifying the uniform and reducing the cost involved in changes of rank. A list of the changes will be seen by referring to the quarterly "Navy List." Officers were required to provide themselves with all types of uniform, as revised, by May 1, 1920. With a view to improving the status of the senior petty officers, the Admiralty on

April 28, 1920, ordered those with over four years' service as such, and who were previously dressed as seamen, to wear the Class III. uniform, with jackets and peaked caps, but with gilt buttons on the former and the gold badge and silver anchor on the latter. A new cap badge was authorised for chief petty officers. The Admiralty also ordered stiff white collars to be worn by C.P.O.'s, P.O.'s, and men not dressed as seamen, when serving in Fleet establishments, or on leave from ships and Fleet establishments, with No. 1 and No. 2 dresses. The soft white collars previously worn were to be allowed with these dresses when the men were actually afloat, and they were always to be worn with No. 3 or working dress.

As regards victualling, the Admiralty announced in June, 1920, that the reductions in the ration allowances of bread and sugar, from 1 lb. to 10 oz., and from 4 oz. to 2 oz. respectively, which were made during the war, would remain in force permanently, Appendix XVI., Part I., of the King's Regulations being amended accordingly. The equivalent value of these reductions was embodied in the messing allowance of 10*d.*, and continued in the increased rate of 1*s.* authorised on March 31, 1920. Since the beginning of the war, the prices at which Service provisions had been issued on repayment to officers and men had been maintained at pre-war levels, as a matter of convenience. It was decided, however, as from April 1, 1920, to revert to the normal practice of fixing the issuing prices on the basis of actual cost to the Government, plus the usual 5 per cent. to cover handling and establishment charges. Concurrently, increases were made in the messing, victualling, and Sunday-dinner allowances, all of which were directly affected by the prices charged for issues on repayment. In view of the improvement in the quality and keeping properties of Government flour effected by recent alteration in its composition, the Admiralty decided, as from January 31, 1920, to supply it to all ships and establishments, including the services for which barley admixture was formerly issued. Admiralty standard flour, however (that is, pre-war standard), was to continue to be supplied to ships proceeding to tropical stations, on account of its superior keeping qualities.

ACCOUNTANTS AND INSTRUCTORS.

It was mentioned in the First Lord's Memorandum * that a Committee had been sitting on the Accountant Branch. The late Vice-Admiral Sir Trevylyan Napier was its President until he left in December, 1919, for the North American Station, when he was succeeded by Rear-Admiral Sir Lionel Halsey, until the latter left England in the Renown in March, 1920. The Board have not, at the moment of writing, taken action on the report, which has not been published, but it may be pointed out that opportunities have been taken since the armistice to give accountant officers increased employment at the Admiralty. On his appointment as First Sea Lord, Admiral of the Fleet Lord Beatty appointed as his secretary Paymaster-Captain F. T. Spickernell, C.B., D.S.O., who was with him all through the war in the Lion and Queen Elizabeth. Each of the six naval members of the Board of Admiralty has an accountant officer as secretary in the place of a Civil Service official, as before the war. There is also a separate department at the Admiralty concerned solely with the Accountant Branch, and presided over by a Paymaster Director-General, and a special course of instruction for accountant officers qualifying as secretaries has been instituted at Portsmouth.

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* *Vide* p. 314.

The reconstitution on a new basis of the Instructor Branch was also mentioned by the First Lord. An order on this subject was issued on January 14, 1920, which provided that in ships the duties of this branch are to include responsibility to the captain for all scholastic instruction of officers and men. Revised rates of pay for the branch, which took effect from January 1, 1920, were published on April 1; and new rates of retired pay on July 14. On May 15, 1920, the Admiralty granted actual, instead of relative, rank to the officers of this branch, and placed them on the same footing in regard to rank and command as officers of the other non-military branches.

NAVAL RESERVES.

The policy of the Board in relation to the important question of Naval Reserves remains undecided. An official statement on April 19, 1920, issued to clear away certain doubts, showed that the Admiralty had decided that those members of the R.N.V.R. who had completed three or more years in that Force might continue to serve, if they wished to do so, under their existing engagements pending further orders. This did not in any way prevent the final discharge of those entitled to it who wished to sever their connection with the Force, nor did it bind any man to serve under the new regulations which might be laid down as the result of the reorganisation of the Reserves then under consideration. "So far as possible with the numbers available," the Admiralty stated, "and the instructional staffs already appointed, drills and training will be resumed and the work of the several Royal Naval Volunteer Reserve Divisions carried on as in pre-war days." On May 17, the Vote for Naval Reserves was withdrawn during the debate in the House of Commons in response to protests against money being voted before a definite scheme had been prepared.

Finally, the past year has been important from the point of view of the lower deck personnel by reason of the establishment of the Welfare Committee, under the presidency of Admiral Sir Thomas Martyn Jerram. The first Admiralty Order creating this Committee and defining its functions was issued on August 30, 1919, accompanied by amendments to the King's Regulations which opened up an avenue of approach to the Admiralty. The Interport Meetings having been held at Portsmouth, the first meeting of the advisory members, eighteen in number, with the Welfare Committee at the Admiralty took place on October 14, 1919. Altogether 307 separate requests, great and small, were put forward, the great majority being class requests, and the Admiralty decisions upon them, issued as a Fleet Order on August 5, 1920, showed that over 100 had been granted in whole or in part, and that others were being investigated by special committees. By this time, the second series of Interport Meetings were taking place at Devonport, and certain representatives from them were invited to the Admiralty and had the privilege of an interview with the First Sea Lord at which the bearing of the 1919 decisions was fully explained. As the result of experience, modifications in procedure in regard to the Welfare Committee were decided upon, and its work should be increasingly beneficial to the Navy.

Apart from the Committee, much was done to promote welfare generally by the Admiralty. A new Physical Training Department at the Admiralty was inaugurated on March 22, 1920. A Sports Control Board was established, of which the Second Sea Lord is ex-officio President. The system of Cruising Clubs and Accommodation Registers, which proved valuable before the war, has been re-started. Officers and men can now purchase goods at naval canteens, at a discount of 5 per cent., for their wives and families, and for the men, a Royal Naval Benevolent Trust had been proposed by the Admiralty to administer relief funds accumulated during the war.

This chapter has run to a length unusual as compared with most of its predecessors, but the period covered has been greater than in former issues, and the transformation from war to peace undoubtedly unique. It is hoped that the foregoing pages will not only have a value as an historical record of the demobilisation of the Fleet after the Great War, and the manner in which the Naval Service was brought back to a peace footing after its splendid achievements during hostilities, but that they will be found to contain indications of the policy upon which the new Navy is being built up.

CHAS. N. ROBINSON.

CHAPTER II.

FOREIGN NAVIES.

A SURVEY of the Navies of the world reveals the naval administrators of the Maritime Powers navigating carefully, as it were, an uncharted sea of doubt and perplexity in their efforts to reach the calm waters of constructional certitude; some few of them boldly daring the dangers, and pushing out into the execution of heroic policies, others timidly venturing, and some fearful to leave harbour until the enshrouding fogs shall have cleared, and left the outlook unobscured. Committees and commissions in every maritime country of the world are exploring, examining, and digesting as best they can, the lessons of the war. They are confused by the disappearance of the Navies against which certain of them built, and hardly less so by Article VIII. of the Covenant of the League of Nations, which prescribes reduced armaments to those nations which belong to the League, but not to those which remain outside or are not permitted to join. The nations continue to watch one another eagerly or jealously, while there is not one of them that does not shrink from the enormous outlay which every step in naval construction involves. This is a consideration which appeals with tremendous force to the greater Naval Powers. Theory does not help them very far. The problem is one that cannot be considered in the abstract. Before 1905 the "policy of Goliath," as the late Sir William White called it, was modest indeed. Nowadays, when the Hood costs well over £6,000,000, and over £500,000 annually to maintain in full commission—costs which will be largely increased in the case of any subsequent ship of the same character—there is evident need to call a halt.

Yet the British Admiralty have no doubt that the capital ship, in the words of Earl Beatty at Glasgow in March, 1920, is "still the unit upon which sea power is built." The First Lord in the House of Commons on March 17 declared that this also was the view of every other great naval country. "There is no country which desires to have a strong Navy which is not to-day actually laying down big ships." He was referring evidently to the United States and Japan.

It is in the United States that this policy finds its most striking expression. The disappearance of the German Navy left Great Britain and the United States the greatest Naval Powers, but, while England is not embarking upon any naval programme, America is pushing forward to the first place in the building of capital ships, undismayed by the possibilities of disastrous attack from above and below, or by the hint given by the British Admiralty that the big ship may yet become submersible. Japan is actuated by the same spirit, and is planning and building capital ships and providing the facilities and resources by which they may be constructed and equipped.

The great nations of Europe find the problem extraordinarily difficult of solution. They are confronted, not only with giving effect to the lesson of the war, but with a complex situation abroad, and economic upheaval at home. In France and Italy work was stopped upon the ships under construction. Yet it was announced in January, 1920, that President Poincaré had signed a bill, or act, authorising the construction of five battleships of the Normandie type, and that the keels would be laid during the year. It is now certain, however, that the ships will not be built. There were many reasons against the policy of their construction. In Italy the great battleships were stopped.

To the Northern Powers the outlook is less uncertain. They have never committed themselves to the Dreadnought policy. It was unnecessary that they should do so, and their resources would hardly have permitted it. They are now engaged in examining every possibility of the future, and tending more and more to entrust their defence to destroyers, submarines, mines, and aircraft.

New Navies are coming into existence in the Baltic. Finland, Latvia, Esthonia, and Poland are making modest beginnings. The kingdom of the Serbs, Croats, and Slovenes may inherit something of the maritime greatness of Austria-Hungary in the Mediterranean. The Ottoman Navy, after a long history, has ceased to exist, and Bulgaria is forbidden any naval preparations or enterprises in the Black Sea.

UNITED STATES.

The United States Navy issued from the war more powerful than any Navy in the world with the exception of our own. It is in progress of rapid expansion through the execution of the shipbuilding programme of 1916, which has been described as "the first far-reaching constructive programme in the history of the Republic," though it suffers from serious difficulties in the raising and maintaining of its personnel. How far, under new political direction, the impetus to material expansion will continue it is as yet impossible to determine. Under the programme of 1916 sixteen capital ships are under construction, ten of them battleships and six battle-cruisers, and these, with nineteen existing Dreadnoughts, and at least twelve pre-Dreadnoughts, will give a total of nearly fifty capital ships in 1925. It is important to notice that, of the Dreadnought fleet of thirty-five units, sixteen ships will mount 16-in. guns and eleven others 14-in. guns. The sixteen ships mounting the heaviest guns will be enough when they are completed to ensure to the United States Navy the first position among the Fleets of the world, unless there should be a new British programme carried out expeditiously. At present Great Britain has the ten Royal Sovereigns and Queen Elizabeths and the Hood to compare with them; the two Renowns will be unequal to the later, heavier, and better-armed Lexingtons.

When Mr. Josephus Daniels, Secretary of the Navy, made his report on the year 1919–20 he spoke in glowing terms of the future. The American Navy, he said, had become incomparably stronger and more powerful than before, and was far in advance of any other Navy, in ships, in men, and in every element of strength. The organisation of the Fleet in two great divisions had given ample defence both in the Pacific and the Atlantic. With battleships in service equal or superior to any then in commission in any Navy, and twelve battleships (including the California and Tennessee, the last-named since commissoned, of the 1915 programme) and six battle-cruisers under construction—some of them larger than any yet in commission, and to be armed with 16-in. 50-calibre guns, more powerful than any afloat—the Navy, he said, was pressing forward to greater things, justifying in peace and war the country's firm confidence in its "first line of defence." He added that the great fleets in the Pacific and Atlantic were well officered and manned, and gave guarantee of protection and of readiness "to serve our country and the world." At Charleston, West Virginia, on August 31, on the occasion of the third anniversary of the commencement of large armour and projectile works, he stated that the delay in the ratification of the Versailles Treaty had prevented any cessation in naval expansion. There had therefore, he added, been no change in the plans for American naval development. "We are not only completing this great plant, but are building enormous docks and other needed shore facilities elsewhere, and are constructing 18 Dreadnoughts, with a dozen other powerful ships, which, in effective fighting power, will give our navy world primacy."

The General Board of the Navy prepared a programme for a further expansion of the Fleet, to be initiated in 1921, "with able argument," said the Secretary, in pursuance of his views and of its own. This plan is still in abeyance. The Board recalled the fact that since 1915 it had maintained that "the Navy of the United States should ultimately be equal to that of the most powerful maintained by any other nation of the world," and that "it should gradually be increased to this point by such a rate of development, year by year, as may be permitted by the facilities of the country, but the limit above defined should be attained not later than 1925." The plan was presented by Rear-Admiral Badger, who said that the scheme was conceived with the idea of giving the United States "the largest Navy in the world." The Board proposed the immediate laying down of two battleships, one battle-cruiser, ten scout cruisers, five flotilla leaders, and some small craft, while upon aircraft construction, including experimental work, a sum of 27,000,000 dollars should be expended. Admiral Badger argued that Dreadnoughts and battle-cruisers of that class would remain the backbone of the Navy, with a tendency towards increased size. It was stated that the intended Dreadnoughts would outclass the British Hood and similar ships planned by the Japanese. The battleships, said Admiral Badger, would displace 44,000 tons, and the battle-cruiser 32,000 tons, both classes carrying 16-in. guns, while the scout cruisers should be of 10,000 tons with 8-in. guns.

Congress has not given effect to these recommendations, though it has made large provision for continuing actively the programme of 1916. The Secretary of the Navy, in commenting upon the Appropriation Act of 1920–21, expressed grave dissatisfaction at its limitations, which he believed the country would not approve. Fleets had been created for the Atlantic and Pacific, but there was failure to make provision for the demands created by the presence of the Fleet on the Pacific Coast—failure also to authorise the construction of a single new ship. The allotment to naval aviation was altogether inadequate, and yet the Navy must have a sufficient air force of its own. Especially deplorable was the failure to provide for the proper repair of ships, work upon which has been neglected during the war.

AMERICAN NEW CONSTRUCTION.

The ships now under construction are of great importance, and, as has been pointed out above, promise to lift the United States Navy to a place in the Naval scale superior even to that of Great Britain.

The North Carolina represents the last six of ten battleships which were provided for under the three years' programme. The first four had been begun as soon as practicable after the passing of the Act. These four, designed for a normal displacement of 32,600 tons, were the Maryland (launched March 20, 1920), West Virginia, Colorado, and Washington (each eight 16-in. 45 calibre guns). A certain amount of progress on these vessels was made before the United States entered the war, during which work on capital ships was practically suspended, to allow more immediately urgent demands to be satisfied.

The Naval Act of March, 1917, directed that construction be commenced as soon as practicable on three more of the battleships in the programme, and the construction of the remaining three was ordered in the Act of July, 1918. All were laid down in the Navy Yards, except the Iowa and Massachusetts, which were placed, after a failure to secure satisfactory tenders, with the Newport News and Bethlehem Shipbuilding Companies in July, 1919, on the basis of actual cost plus a fixed profit of 1,650,000 dollars.

The six battleships of the North Carolina class, completing the programme, are as follows: South Dakota and Indiana (Navy Yard, New York), Montana (Navy Yard, Mare Island), North Carolina (Navy Yard, Norfolk), Iowa (Newport News Shipbuilding Co.), Massachusetts (Bethlehem Shipbuilding Co., Quincy, Mass.). Their principal characteristics are: length between the perpendiculars, 660 ft.; length overall, 684 ft.; extreme beam, 106 ft.; mean draft, about 33 ft.; displacement, about 43,000 tons; shaft horse-power, estimated 60,000; speed, estimated 23 knots. Armament: twelve 16-in. 50 calibre guns in four turrets, sixteen 6-in. guns, four 3-in. guns (anti-aircraft), two 21-in. submerged torpedo tubes.

All the vessels will be oil burners, with electric drive. Their complements will include about 70 officers and nearly 1400 chief petty officers, enlisted men, and marines. They will have large cruising range. Their armament, armour, and under-water protection against torpedo attack will be unusually complete They will be equipped with high-power wireless. There will be reception and reading rooms for the crew; the men's quarters will be heated and ventilated by a system of warmed forced air. Complete sick-bay accommodation and dental offices will be provided. Showers with hot and cold water appliances, a barber's shop, laundry, and complete victualling departments are included. The great care bestowed upon providing comforts for the men is part of the necessary policy of doing all that is possible to attract recruits to the service. The Massachusetts and the Iowa will be completed in about forty-two months from the time of laying their keels. The Bureau of Construction and Repair examined the question of providing against attack from the air with the purpose of determining what modifiction of design might be necessary, and before the ships are completed the results of an investigation conducted by a committee under Admiral David W. Taylor will be available, and the superstructures of the ships will be made to conform to the needs.

Six battle-cruisers of the Lexington class were provided for in the three years' programme, four of them at a cost, exclusive of armour and armament, not exceeding 16,500,000 dollars. The construction of the fifth vessel, at a cost not exceeding 19,000,000 dollars, was ordered in March, 1917. Owing to the necessity for concentrating the work of shipbuilding upon destroyers and other smaller craft, no work on the battle-cruisers was undertaken prior to the armistice, and it was then determined to reconsider their design (which had originally contemplated vessels of about 35,300 tons, and 35 knots speed) so as to provide greater protection against submarine and air attacks and other details, the importance of which had been demonstrated during the war. Work was suspended in March, 1919, and the questions were investigated by the Secretary of the Navy and the chiefs of the technical bureaus who accompanied him abroad in the spring of that year. The whole matter was subsequently considered by the General Board, which recommended greater protection against gun-fire and under-water attack, with increased displacement and corresponding loss of speed. The sixth battle-cruiser has been laid down at the Navy Yard, Philadelphia, under the same conditions as those which preceded it. The Act of July 11, 1919, increased the limit of cost to 23,000,000 dollars, exclusive of guns and armour, and revised plans of the vessels were approved by the Department and issued to the contractors and to the Navy Yards in September, 1919, providing for the following characteristics: length between the perpendiculars, 850 ft.; overall, 874 ft.; extreme beam, 105 ft. 5 in.; mean draft, about 31 ft.; displacement, about 43,500 tons; shaft horse-power, estimated 180,000; speed, estimated 33·25 knots. Armament: eight 16-in. 50-calibre guns in four turrets, sixteen 6-in. guns, four 3-in. guns (anti-aircraft), four 21-in. submerged torpedo tubes, four 21-in. above-water torpedo tubes. The latest report of the Secretary of the Navy stated that the last two of the series, Saratoga and United States, would have 18-in.

guns in lieu of 16-in., but this appears to be incorrect. The vessels will be oil burners with electric drive. Accommodation will be provided for 65 officers and 1250 men, though the complements have not yet been definitely assigned.

The three years' programme of 1916 included ten scout cruisers, and the construction of four of them was immediately authorised at a cost not exceeding 5,000,000 dollars each, excluding guns and armour. The Act of March 4, 1917, authorised construction of three more (cost increased to 6,000,000 dollars), and the balance of the programme was authorised in July, 1918 (limit of cost, 7,500,000 dollars). Owing to the necessity of concentrating on other types of vessels during the war, no active construction on the scouts was undertaken, and on account of changes in firms holding certain of the earlier contracts and of other conditions, new contracts covering all ten vessels were drawn, on a basis of actual cost plus a definite sum for profit, in the early part of 1919. The ten vessels, to which no names have yet been assigned, are now building as follows, at least half of them being reported from 30 to 48 per cent. completed on May 1, 1920: Nos. 4, 5, and 6 by Todd D.D. and Constr. Corp., Tacoma, Wash.; Nos. 7 and 8 by Bethlehem S.B. Corp., Quincy, Mass.; and Nos. 9, 10, 11, 12, and 13 by Wm. Cramp & Sons, Philadelphia. The chief characteristics of these scouts are: length between perpendiculars, 550 ft.; overall, 555 ft. 6 in.; beam on L.W.L., 55 ft.; mean draft, about 13 ft. 6 in.; displacement, about 7100 tons; shaft horse-power, estimated 90,000: speed, estimated 35 knots. Armament: eight 6-in. guns, two 3-in. (anti-aircraft), two 21-in. torpedo tubes (above water). The vessels will be oil burners, with turbine drive. Their complements, as at present contemplated, will consist of 26 officers and 330 men.

With regard to submarines, the Naval General Board believed the best plan would be to build trial boats of three classes: (*a*) A long-range submarine with heavy armament and the longest practical wireless range; surface and submerged speeds to be moderate, but with considerable submerged range, four bow and two stern tubes, fifteen long 21-in. torpedoes, two 6-in. guns and one anti-aircraft gun; about 300 ft. in length and 2000 tons surface displacement and 14 knots surface speed. (*b*) A long-range minelayer, generally modelled upon the ex-German submarine U-117. (*c*) A general purpose submarine of moderate size, between 200 and 250 ft. in length, and corresponding surface displacements of 800 to 1000 tons. Congress has not ratified these recommendations.

To provide for the execution of the naval programme, "a yard development programme," increasing the plant and facilities of the dockyards, was prosecuted throughout the war, and is still going forward. The private yards have developed still more rapidly.

The development and use of aircraft in naval warfare during the recent war had shown the great possibilities of this branch of the service in scouting, spotting, and actual attack against vessels with guns, torpedoes, and bombs. The needs of the United States Navy in aircraft for the year 1921, for the purpose of carrying out the Naval General Board's aviation policy as approved by the Naval

Department, would have required for heavier-than-aircraft, 11,000,000 dollars; lighter-than-aircraft, 10,000,000 dollars; and experimental construction, 6,000,000 dollars, this sum not including what was necessary for the maintenance of the existing air fleet. The Secretary of the Navy deplored the parsimony of Congress in voting only 20,000,000 dollars for the whole service. On the figures of the estimates, however, as adopted, the total sum is 25,000,000 dollars. He said: "In the United States at present, instead of proceeding to give to the Army and to the Navy what these organisations deem necessary for their progress in the development of aeronautics, the Congress has wasted much time and effort to effect a unification of the military and naval air services with civil organizations in a way which cannot be satisfactory to either military, naval, or civil interests. The Navy must have its own organisation, and the sooner this fact is accepted, and it is made possible to proceed with an advancement along the lines indicated as necessary by naval experts, the more rapid and satisfactory will be our progress and the greater will be the economy to the Government in the new development. I appeal to all who believe in the possibilities of aviation to aid in securing well-considered legislation and adequate appropriations at the December session. The Navy will do all it can with the present facilities and money, confidently looking forward to practical appreciation of the commanding importance of aviation when Congress next convenes. In fact, we are already making large plans in keeping with the conquest of the air for presentation in December." It appears possible to procure about 100 aeroplanes for the use of the Navy and the marine corps, and probably thirty-eight lighter-than-air machines, but not to proceed with the building of rigid airships. This is the Secretary's estimate, but the allotment of money provides for building one rigid dirigible, purchasing another abroad, building two hangars, and other work. Fifteen "torpedo planes" have been placed on order. The Fleet Air establishment has been removed from Long Island Sound to Chesapeake Bay.

PERSONNEL OF THE U.S. NAVY.

A painful situation arose with regard to the personnel of the United States Navy. The Fleet was most seriously affected by the great economic upheaval. Admiral Sims, Admiral Wilson, and other officers told the sad tale of the hopeless embarrassment of officers owing to the reduced purchasing power of money. Many of them sought resignation. In April, 1920, 1000 of them had retired since the armistice. Within a year 270 midshipmen retired from the Naval Academy, many of them because they had formed a "distaste" for the service; some because they considered themselves unequal to its demands; and others for various alleged reasons. Rear-Admiral Washington, Chief of the Bureau of Navigation, speaking before the Committee which investigated the charges of Admiral Sims, expressed the opinion that, unless the wastage was arrested, "90 per cent. of those on the list of officers would be inexperienced boys." Recruiting for the lower deck fell off to an alarming extent. It was stated that the Pacific Fleet navigated with undermanned ships, and that the Atlantic Fleet was approaching a state in which its ships would have to be put out of commission, because men would not serve when pay was two and a half times below prevalent rates ashore and in the mercantile marine. Admiral Washington stated that Congress would have to increase the pay both of officers and men if the Navy was to be saved from disaster. During the second half of 1919, there was a total of 4666 desertions, including 1000 petty officers, while during the year 1920 the Navy was losing trained men at a rate approaching 1000 every month. To remedy this state of things great efforts have been made to stimulate recruiting, by showing the comforts and advantages of the Service, especially in carrying youths abroad, making them acquainted with the world, and providing them with training and experience which will be invaluable in their future years. But the difficulty is still great, because the new men possess neither the spirit nor the broader experience of the men who served in the war, and who were the backbone of the rank and file. The required strength is 170,000 officers and men, (shortage in June, 1920, 66,026) and of the Marine Corps 27,400 (shortage 11,687). In July there was a certain recovery, these shortages being reduced to 31,646 and 11,369 respectively.

The shortage of men has not interfered with the operations of the Fleet. Two Battle Divisions cruised for three months with midshipmen from the Naval Academy, and another division, with 40 or 50 destroyers and submarines and auxiliaries, has engaged in extensive autumn manœuvres. The battleships have made great advances in gunnery, which the Navy Department considers is at least equal to that of any foreign vessels of the same date.

A somewhat embittered controversy arose from the protest made by Admiral Sims last December against the honours list issued by the Secretary of the Navy, in which many personal questions were raised. From this controversy arose an accusation that the Navy Department had been neglectful in preparing the Navy for war, and Admiral Sims was accused of being pro-English. It is unnecessary to enter here into these controversial discussions in the administrative work of the great friendly Navy of the United States.

JAPAN.

In the financial year 1916–17, the Japanese Diet adopted a programme of naval construction, which had the object of constituting a strength in capital ships of eight battleships and eight battle-cruisers, not any one of which should exceed eight years in age. In addition were light cruisers, destroyers, submarines, and auxiliaries. The last of the capital ships was to be commenced in 1923–24. In pursuance of the programme, the battleships Nagato and Mutsu, both of which have been launched, and the Kaga and Tosa, in an earlier stage, were put in hand. They are ships displacing 40,600 tons, mounting eight 16 in. guns and twenty 5·5-in. guns, and designed for a speed of 23½ knots. These four ships, added to the modern battleships now in commission, Fuso, Yamashiro, Ise, and Hyuga (each twelve 14-in. guns), would give the eight ships required.

But, inasmuch as the Fuso and Yamashiro will become obsolete, by the standard of age, by 1924–25, it is perhaps unlikely that the age standard can be maintained, though in principle it has not been abandoned. The difficulty is greater in the case of the battle-cruisers. Provision has been made for four—Amagi, Akagi, Atako, and Takao—but only two have been laid down, and they are not far advanced. They are said to be ships of 40,000 tons, designed for a speed of over 30 knots, and to carry eight 16-in. or larger guns, but the particulars are uncertain, and are given under reserve. The four existing battle-cruisers are the Kongo, Hiyei, Kirishima, and Haruna, but the first-named will reach the age limit in 1921–22 and the Hiyei in 1922–23. At present the two Government and two private yards have each one slip, or building berth, capable of taking a modern capital ship. There has been great depression in the shipping interests of Japan, the shipyards being chiefly employed in Naval Construction, and the shipbuilding programme had doubtless some relation to the crisis in the shipbuilding industry. In addition to supplies for naval construction, the Japanese Navy Department has been granting money to extend plants and accelerate output. It may, therefore, ultimately become possible for the Japanese yards and the plants which feed them to attain the necessary capacity for the execution of the purpose of the naval programme.

This appears to be the expectation of the Japanese Navy Department, and therefore an additional programme was introduced in 1920. Originally it was intended to present a limited programme of two battle-cruisers and auxiliaries, but it has since been decided to bring forward an enlarged scheme, to be completed in 1927–28, supplementing that of 1916–17, including four battleships, four battle-cruisers, and twelve light cruisers, besides destroyers and submarines. The four battleships will be substitutes for the Fuso, Yamashiro, Ise, and Hyuga (which will all pass their age limit in or before the year 1926–27), and the four battle-cruisers substitutes for the Kongo, Hiyei, Kirishima, and Haruna (which, in the same way, will have all passed the age limit in 1923–24). The Minister of Marine, speaking before the Budget Committee of the House of Representatives in July, 1920, said that Japanese yards could now complete two capital ships each year. The light cruisers undertaken by virtue of the programme of 1916–17 were the Tama, Kitagami, and Ohi, launched in 1920, and the Kuma, Kiso, Nagara, Isuzu, and Natori, in earlier stages. The twelve light cruisers of the new programme will conclude the series. They will displace 5500 tons, carry seven 5·5-in. guns, and be designed for a speed of 36 knots. The Yura has been laid down. These are interesting vessels. Their 5·5-in. guns are disposed in two groups, none of them being superimposed. At the bows are two on the keel-line forward of the conning-tower, and two others are on either side, abreast of it. Behind the conning-tower is a tripod-mast. Three funnels are amidships. Abaft of these are two other guns, then a pole mast, and sternmost is the seventh gun. There are believed to be four 21-in. torpedo tubes. The protection is 2 in., presumably on the deck.

Turning to the submarine programme, while the details are not disclosed, it is understood that the strength of the flotilla had been increased to about forty by the end of the last financial year, the credits coming from funds voted at the fortieth and forty-first sessions of the Diet. It is stated that about 300 experts and mechanics were sent to France and Italy by the Japanese naval authorities to study submarine construction. A considerable number of submarines are being added, and pending the erection of a special building, the battleship Shikishima is being used as a school and depôt ship. The seven ex-German submarines allotted to the Japanese reached Sasebo.

JAPANESE NAVAL POLICY.

With regard to the policy which underlies the Japanese shipbuilding programme, the Minister of Marine, describing its features to the Budget Committee of the House of Representatives in July, said it was not directed against any potential enemy, but was the measure of the necessities arising from the country's insular position, although the possibility of the despatch of foreign strength to the Orient had not been disregarded. At an earlier date the *Jiji Shimpo*, discussing the supplementary programme, of which the general character had become known, referred to its relation to the disarmament clause of the Covenant of the League of Nations. The news that Japan contemplated a new programme of shipbuilding for the Navy would not, it was apprehended, be received favourably by foreign Powers. The fact was, however, that the question of the programme of sixteen capital ships, which Japanese naval authorities regarded as the minimum of strength necessary for national defence, had been pending ever since the time of the Russo-Japanese War, and the whole nation desired its fulfilment. Progress had been interrupted by political and financial considerations, but the question was not new. The programme, therefore, said the *Jiji Shimpo*, should not make Japan an object of suspicion to foreign Powers. "Even if all the Powers of the world carry out the limitation or reduction of national armaments, to reduce the naval strength of Japan below the 8-8 standard would be inconsistent with her national safety and her geographical situation and circumstances." But when Admiral Kato, Japanese Minister of Marine, was in England in September, 1919, he had said Japan would like a general agreement for disarmament, but was waiting to see what was being done in that way by the other great Powers.

The programme of the Japanese Navy, hampered as it is by financial depression, will be followed with great interest. It might have been supposed that the plan of 1916-17 was conceived at the time when nearly every one in Japan believed Germany would never be beaten, and that therefore the Alliance could be of little protective value to Japan, but the new programme, brought forward at the time when the Alliance was about to be renewed, forbids such a conclusion. Undoubtedly, therefore, if the programme receive effect, it can only be because of national necessities which compel the Japanese

Government to establish a situation which will give the country, not only a Fleet of sixteen very modern ships, but a considerable force of powerful ships a little less modern. Every effort is being made to maintain the efficiency of the Fleet. The Naval Manœuvres in October, 1919, were the most extensive in the history of the Japanese Navy, and included several actions and aeroplane attacks on the coast towns. The operations were shadowed by an explosion which occurred in the battleship Hyuga in Tokio Bay, whereby fourteen men were killed and thirty injured. A gun-turret was blown overboard.

FRANCE.

French naval policy is ruled in great measure by the dominant necessity of retrenchment, and disturbed at the same time by a conflict of opinion as to the character of the Navy of the future. The shipbuilding programme of 1912, under which provision was made for the construction of five battleships of the Normandie class, was arrested by the war, but considerable progress had been made in giving effect to the programme. All the ships have been launched, and the continuation of the work had the formal approval of President Poincaré in January, 1920, but M. Georges Leygues, then Minister of Marine, decided to abandon the construction of these ships. This step was taken with the approval of the Superior Council of the Navy, whose members thought it unwise to continue to build ships which in type would be inferior to the ships which they might have to engage. Unless, therefore, some new decision should be arrived at, the ships will not be completed. They are of 24,802 tons, and each was to have mounted twelve 13·4-in. guns in three turrets. The ships were to have cost in round figures £16,000,000, and an estimate of the outlay as modified to meet new conditions showed that the sum would be increased to £28,000,000 or more. The Béarn, last of the series to take the water, was launched at La Seyne in April, and will be used as a sea-plane base and barrack ship at Toulon.

At the time when the late Lord Fisher was condemning the existing type of capital ship, thought was moving in the same direction in the French Navy. Many officers held that there was at least leisure for examination of the problem, and for reflection. Several Admirals favoured a return to the principles advocated by the late Admiral Aube and the Jeune Ecole, in which the strength of the French Navy would reside in "le nombre, la vitesse, l'invulnerabilité, la spécialization." Admiral René Daveluy, who is a master mind in the French Navy, the author of remarkable books on strategy and tactics and the exponent of Mahan, has ranged himself with those who foresee a radical change in the methods of naval warfare. In writing recently on the ship of the future he has declared that the solution of the problem lies in the adoption of forms altogether different from the traditional ones. There must, in his opinion, be a modification to secure protection from submarine attack. Will the fighting ship of the future be armoured? Admiral Daveluy replies: "It is probable, for, like her predecessor, she will have to protect herself against enemy guns." As for Dreadnoughts, he regards their day as past. Accordingly the Admiral urges the construction of numerous submarines, swarms of bombing seaplanes, and the fastest light cruisers and destroyers. He says that, with the exception of England, no Power enjoys a position so favourable as that of France for the utilisation of flotillas and especially of the means of aviation.

M. de Kerguézec, Reporter of the Committee on Finance, presumably inspired by this opinion, introduced the question in the Chamber in March, 1920. He declared that France had no naval policy, and advocated a defensive based on the possession of flotillas. "The day on which France will be backed by a fleet of 250 to 300 submarines she will be able to contemplate the future without any misgiving whatever." To France were left forty-four German submarines, but thirty-four of them were to be destroyed under a clause of the Peace Treaty. He felt sure he would have the support of the Chamber in asking for a revision of this clause. He did not believe the state of French finances would permit her to pursue costly experiments in the construction of bigger ships.

These arguments did not carry weight with the whole French Navy. It was pointed out that, valuable as the submarine was, it was the naval weapon which had lost most in the war. The German submarine would not have been defeated if the British Fleet had not blockaded the Fleet of Germany. Its failure was due to the superiority of British power on the surface of the sea. Again, the cost of the submarine, ton for ton, was greater than that of the battleship, and it was far more perishable. The Clorinde class of submarines cost 4505 francs per ton and the battleship France 2719 francs; while, if to maintain the battleship in commission would cost 87 francs per ton, the Clorinde would cost 365 francs. The *Temps* arrayed these figures, and declared that it would be seen into what an orgy of expenditure France would be led by adopting a programme of 250–300 submarines, "d'un type puissant, robuste, capable de braver tous les temps!" It was also remarked by the *Temps* that Mr. Long, in the House of Commons, had replied to M. de Kerguézec before the latter spoke, adding that, after the decisive offensive of Marshal Foch against the Germans and of the British Fleet against the German submarine, it was strange to hear pleas for the maintenance of a merely defensive navy.

Before M. Leygues left the Ministry of Marine, stating that the programme of 1912 had left France destitute of light cruisers for scouting and other uses, he introduced in January a plan for the construction of six cruisers of 5000 tons, with speed of over 30 knots, mounting eight 5·5-in. guns, and also twelve squadron destroyers of 2000 tons, and over 36 knots speed, carrying 3·9-in. guns. These vessels seem not yet to have advanced beyond the stage of design. Many light craft have, however, been added to the Fleet, including 60 despatch vessels (about 20 not yet completed) and a series of 115 submarine chasers, and eight motor launches built by the Niclausse Company—250 tons, 80 H.P., heavy petroleum motors.

FRENCH NAVY ESTIMATES.

The Navy Estimates were presented in June, 1920, but in an incomplete form, and the customary statement showing the cost on every account of the new constructions and those already in hand was absent. This proceeding was considered of doubtful legality. It was said that the deputies voted in ignorance of what they were voting for. The programme was restricted, and included only the destroyer Enseigne Gabolde, 880 tons, three submarines of the O'Byrne type, and two mine-laying submarines, Maurice Collot and Paul Chailley. The new Minister of Marine, M. Landry, claimed to have examined every head under which it was thought that economy could be effected, but M. de Kerguézec's committee made a further minute examination and a "triple compression," reducing the original demand of 905,851,000 francs, representing about £36,000,000, to 850,860,611 francs, a reduction of £2,000,000; 792,237,211 francs were for the ordinary estimates and 121,623,400 francs for the extraordinary. The ships in commission were reduced in number, and many of them given only about 50 per cent. of their proper complements. Three of the older battleships were condemned, and from three others the big guns have been removed preparatory to their condemnation. Twenty-two destroyers and 42 submarines have gone. One critic said that the only thought was "faire vivre le personnel," but was asked what was the use of maintaining the personnel if the men were not trained at sea, and if ships were not built? There was a necessary equilibrium between the ships in commission and the new constructions. These criticisms emanated from the school of Admiral Daveluy, and certain remarks which he made in his former book, "La Lutte pour l'Empire de Mer," may be quoted here in relation, not only to economies in the French Navy, but in our own:

> It is only by navigating that the right efficiency and the initiative of the officers are developed, the crews made familiar with their element, and indifference and listlessness due to inaction warded off. Fleet exercises have for effect to revive the seaman's interest in his vocation, and make for the study of the solution to tactical and strategical problems. Manœuvres, intelligently conceived, give the personnel a feeling of force and worth. When the gunner is aware that his projectile will reach the mark, he has no fear of meeting the enemy: he is sure of victory.

In the course of the discussion of the estimates, M. Leygues paid a high tribute to the great work of the French Navy during the war; M. Thomson, who, as Minister of Marine, in 1906, in the face of fierce opposition, added several battleships to the French Navy, advocated again the fleet of *capital ships;* and M. Landry declared that France must again resume her place in the world. With regard to the surrendered German submarines, M. Boussinot said that, of the total of 187, 124 went to England and 19 to Italy. He, too, protested against those allotted to France being destroyed, but M. Landry told him that M. Leygues at the Conference had won ten as additions to the Navy, while the other Powers had not fared so well. Of these two are mine-layers. It may be added that other surrendered ships which arrived at Cherbourg and Brest were the battleship Thüringen, the light cruisers Königsberg, Stralsund, Kolberg, and Regensburg, and a number of destroyers; and at Toulon the Austro-Hungarian light cruiser Novara. The five cruisers have received the names of towns in Alsace.

FRENCH NAVAL STAFF CHANGES.

M. Landry has made some very important changes in the Naval Staff and the Superior Council of the Navy. The former is now organised in the four departments—(1) organisation, (2) intelligence, (3) operations and plans, and (4) transport; and there are three attached sections concerned respectively with the naval air service, history, and hydrography. It is thus brought much nearer to the organisation of the Army Staff. The Superior Council of the Navy partakes in large measure of the functions of the British Board of Admiralty and the Committee of Imperial Defence. The purpose has been to enable the Minister to summon the most experienced counsel whenever necessary, and, therefore, all the permanent members reside in Paris. Their duty is to advise on preparation for war and the participation of the Navy in the defence of the coasts. The Council must always be assembled on matters concerning the general organisation of the Navy; naval programmes, character of ships of all classes, including aeroplanes and dirigibles; operations; tactics; the adoption of new engines of war and the improvement of those existing; construction or suppression of arsenals and bases; recruiting and the utilisation of officers and men—all these matters come within its view. The Council consists of the Chief of the Staff and six Vice-Admirals chosen by the Minister, possessing certain qualifications, and appointed by Decree. One of them, Vice-Admiral Amet, is Inspector-General of Matériel, and another, Vice-Admiral Schwérer, of Personnel. The Minister of War and members of the Superior Council of War may be called to advise on the related duties of the naval and military services.

Armed with this advice, M. Landry has been able to arrive at two important decisions, inspired with the object of economy, one of them, which appears to present some disadvantages, concerning the Fleet, and the other the arsenals. The Mediterranean Fleet (Armée Navale) has been suppressed and replaced by two entirely independent squadrons, each commanded by a Vice-Admiral, whose spheres of operations lie east and west of the line Cape Passaro-Malta-Ras Ashdir. In the Eastern Mediterranean, the Lorraine was chosen as the flagship provisionally, a division of three armoured cruisers, Waldeck-Rousseau, Ernest Renan, and Edgard Quinet, being attached to the flag under a Rear-Admiral. In the same Eastern command is the Syrian Division (Rear-Admiral), based on Beyrout, and consisting of the Jurien de la Gravière and a number of supply and cold storage vessels. Other groups determined upon were: (1) two flotillas, each of six sea-going torpedo-boats of the Tonquinois class; (2) six despatch vessels, Scarpe, Suippe, Yser, Tahure, Dunkerque, and Toul; (3) six gunboats, Du Chaffault, Duperré, Capricieuse, Agile, Tapageuse, and Espiègle. The armoured cruisers spend six months at sea, followed by three months in port, and the service of the smaller vessels is limited to eight months in the year. The Second Squadron comprises the battleships France, Courbet, Jean Bart, Provence, and Bretagne, three of them with special complements, and the others with nucleus crews in the state known as "disposibilité armée." Attached to the squadron is a flotilla consisting of the destroyers Casque, Capitaine Mehl, Commandant Bory, Bouclier, Roux, and Mangini, with a replacing flotilla of six boats at Toulon. Many of the arrangements in the Eastern Mediterranean were made in connection with the Syrian operations. In order to secure a single command in case of war, one of the Vice-Admirals is provided during peace with a commission as Commander-in-Chief, and flies a square flag of the national colours with three white stars in triangular form in its blue section.

The arrangement now existing for the ports and arrondissements is to be changed. Since 1887 the idea has several times been mooted to do away with Lorient and Rochefort as naval arsenals. The interests in those places have objected and nothing has been done. The Superior Council of the Navy has now, however, declared that no military disadvantage will arise if the two ports be ceded to industrial use and control. The third arrondissement (Lorient) will be suppressed and attached to the second (Brest), but there will be a sea front command at Lorient under a Rear-Admiral. Rochefort will be more important as a base for flotillas, sea-planes, and dirigibles, where training can go on in flying and its science, and other subjects. Rochefort will also be developed as a supply base for merchant ships and the fisheries. It will retain its Naval Prefect, with a command of the coast from the Loire to the Bidassoa. Rochefort will therefore be a place capable of great and rapid development in time of war. An arsenal which is to cease to be a charge upon the Navy votes is Guérigny with its factories and establishments. Bizerta is to be developed commercially.

ITALY.

The year has been a remarkable one in the history of the Italian Navy—a year of severe and wise retrenchment, and of striving to master the teachings of the war. The future of the Navy cannot be forecast, but the strategic situation of the great peninsula, so evidently dependent upon the sea, will forbid Italy, however great may be her difficulties, to allow her Navy to decline. "La geographia è l'argomento capitale," said Signor Giolitti. So far as indications are discernible, she is likely to devote her resources more and more to the building of flotillas and the provision of mining craft and material. In so far as bigger ships are concerned, the probabilities are that she will recur to what may be described as her traditional policy of heavy armament and light protection, with high speed.

The country had suffered much from the oppressive threat of the Austro-Hungarian Fleet in the Adriatic, but, with the peace, the tension was relaxed, and a new era opened. Italy has swept away the menace for some years to come. The Viribus Unitis and Szent

Istvan were destroyed by the remarkable action of Italian officers, and the Tegetthoff and Franz Ferdinand, with a light cruiser, were brought under the Italian flag to Venice. No Dreadnought remained, therefore, on the eastern side of the Adriatic. Pola and Trieste, which had been Austrian, passed to Italy, and the Adriatic situation was completely changed. The anxieties of many years passed away. But the events of Fiume created a position fraught with danger, and it seemed as if the old problem might yet again lift its head. The action of Admiral Millo—the same officer who commanded in the destroyer raid in the Dardanelles in the war with Turkey, and became Minister of Marine in July, 1913—and of the officers who sympathised with him, was a severe trial for the discipline of the Italian Navy, from which it has emerged with its fine spirit undimmed. That action must not be misjudged. It sprang from a highly patriotic impulse.

Maintenance of the Fleet was complicated by the effects of reaction after the war, and the social trouble that was its consequence. The scarcity and high cost of coal, oil, and of every requirement were such that work could proceed only with the utmost difficulty, and it was hardly possible to send the ships to sea. Labour troubles, strikes, and syndicalism created an embarrassing situation, affected the personnel, and partially paralysed the service.

SHIPS DISCONTINUED AND SCRAPPED.

A demand was made for immediate retrenchment on a large scale, and reductions became imperative. An outcry arose against the Navy. In France it had been said, "La Marine a fini son œuvre; pourquoi s'en préoccuper?" and the same thing was said in Italy. The Minister and Staff, assisted by technical officers, examined the question closely, and, there being evident ground for reduction in the changed international situation, the authorities quickly arrived at important decisions with that object.

The first decision was to discontinue the construction of the four great battleships Caracciolo and Cristoforo Colombo (in hand at the dockyard at Castellammare), Francesco Morosini (Orlando, Leghorn), and Marcantonio Colonna (Odero, Genoa). These were ships of 28,000-31,000 tons, to be protected by the thickest armour in the Italian Navy (13 in.), to carry eight 15-in. and sixteen 6-in. guns, to be propelled at 25 knots by oil fuel, and to have complements of 1300 officers and men. The origin of the programme under which these ships were being built was after the peace with Turkey. It had been feared that another Power might intervene, and an agitation arose in the country for an increase of the naval programme, and great preparations were made for laying down the four Dreadnoughts. The estimates of 1913-14 left only about £10,000 available for naval purposes, and the resulting programme was a disappointment. There was an outcry, and the Finance Minister, who had restricted the programme, threatened resignation. Later in the year the programme was definitely adopted, the ships were laid down, and considerable progress had been made before August, 1914. Work did not cease, and was, indeed, more energetically pushed forward until Italy's attitude became defined. Subsequently the building was stopped altogether, attention being paid to the flotillas and the pressing demands of the war. The Italian Government had before it the decision of the British Admiralty to discontinue the Hood's sisters, the Howe, Anson, and Rodney, and it followed the same course with the Italian ships. The Caracciolo and Francesco Morosini appear to have been the most advanced of the series. The Cristoforo Colombo was at once dismantled. It does not follow that ships like these, though arrested in construction, can be left out of the naval account, there being South American Republics which might conceivably become customers of the Orlando and Odero concerns for their completion.

The Italian Naval Ministry had no difficulty, though with great regret, in condemning the Leonardo da Vinci, a sister of the Conte di Cavour and Giulio Cesare. The ship was completed in December, 1912, and on August 2, 1916, was sunk at Taranto as the result of an explosion in the after magazine, followed by fire. Generally it was considered that she was a total loss, but the Italian Royal Corps of Naval Engineers have made it a point of pride and professional accomplishment to salve every ship which it has been at all possible to float. They have had many successes, but never undertook such a great work as to save the sunken Dreadnought. She was refloated, and taken into dock in the late summer of 1919, and it was announced that she would be completely repaired and refitted. In the present situation of affairs this decision has been reversed. The ship therefore remains as she was, though she may yet conceivably find a purchaser.

The Older Ships.

Having dealt with the new ships the Minister and his staff turned to the older ones. It was decided to scrap or sell the Ammiraglio di St. Bon and Emanuele Filiberto, 9645 tons, four 10-in. guns, which were completed in 1901. The process is certain to go further. The Napoli, which carries the mixed armament of two 12-in. and twelve 8-in. guns, is practically condemned, and with her will go her sisters the Regina Elena, Roma, and Vittorio Emanuele III. The old Sardegna, though still on the list, has no fighting value, and cannot long remain. The list of cruising vessels has been reduced by removing the light cruiser Basilicata, and the scouts or flotilla leaders Leopardo, Lince (both building at Genoa), Nibbio, and Sparviero. A sister vessel, the Carlo Alberto Raccia, was sunk at Odessa in July, 1920. By a courageous stroke of the pen, and by the fortunes of war and the misfortunes of peace, the Italian armoured fleet has been reduced, if we exclude the ships named above, to five battleships and five armoured cruisers, with a list of twenty-two cruising vessels and scouts or flotilla leaders (some of them mine-layers), the latter including the Premuda (ex-German V 116). The surrendered vessels are included in these figures. In addition to the Premuda, the German Graudenz, Pillau and Strassburg, and the ex-Austrian small cruisers Helgoland and Saida have been transferred to the Italian Navy.

It is in the expansion of her flotillas that we find Italy at work constructively, though here also the situation demands the exercise of caution. The destroyers remain the same, except that eight of the older boats, chiefly those built by Schichau at Elbing, having become useless, have been scrapped. Of the torpedo boats seven have gone from the list, but the new class of 130-ton boats, with 27 knots speed, each carrying one 6-pr. and having two torpedo tubes, initiated in 1912, has been increased to sixty-six boats, allowing for three which have been lost. They are numbered from 1 to 69, with letters indicating the builders and places of construction. In the submarine flotilla, everything is modern. No boat is retained which was built before 1915, and the total number is sixty-four.

It will be seen from this survey that the Italians, favoured by the disappearance of their old enemy, if once a friend, are making economies which had become inevitable, and biding their time. The Navy has always been patriotic, high-spirited, efficient, and enterprising, and we may be sure that it will so remain.

THE LESSER NAVAL POWERS.

SPAIN.

The light cruiser Reina Augusta Victoria, 5778 tons, ten 5·5-in. guns, has been launched at Ferrol, after having been in hand some years. The programme includes three more of the class, as well as destroyers and submarines. This project dates from 1913, and the whole of the work, including plant and supplies at the dockyards, was then estimated to involve expenditure of £11,000,000. Since the Armistice it has been decided to lay down three gunboats which were part of the programme.

GERMANY.

The German Navy has been completely reorganized since the Armistice on its reduced basis under the terms of the Treaty. The dual arrangement which existed under the Empire has been done away with, but another seems to have been substituted for it. The State Secretary for the Navy Department, for many years Admiral von Tirpitz, dealt with material in the largest sense, and included the personnel within his purview. He also represented the Navy in the Reichstag, and worked more or less in association with the Chief of the Admiralty Staff, who was concerned solely with Operations. There is now a Chief of the Admiralty (Chef der Admiralität), to which office Admiral Behnke, who commanded the Third Battle Squadron in the Battle of Jutland, with his flag in the König, has recently been appointed. This officer has a larger function than his predecessor of the Admiralty Staff, but some of the duties, including finance and parliamentary representation, have been transferred to the Ministry of Imperial Defence (Reichs-Wehr-Ministerium). A new dualism appears to have been set up. The Navy has lost its actual and relative importance, and its future is obscure. No new construction is in hand, but the ships are being kept in repair, and efforts are being made to train officers and men.

The terms of the Armistice and Treaty were observed with commendable punctuality by the central naval authorities, and the scuttling of the ships at Scapa Flow having been taken account of, the Navy is now on its post-War footing. The six battleships allotted to it were all completed between 1904 and 1908, and each mounts four 11-in. guns. They are the Braunschweig, Elsass, Hanover, Hessen, Schlesien, and Schleswig-Holstein. The six light cruisers were all completed between 1901 and 1905, and each carries ten 4-in. guns. They are the Amazone, Ancona, Berlin, Hamburg, Medusa, and Thetis. Of the twelve destroyers three are of the older class, prior to 1911, and the others more modern. There are also twelve torpedo boats of little value. In addition to these ships and vessels Germany is permitted to maintain some others, with the proviso that they shall be kept in reserve, retaining their armament, but having empty magazines. They are the battleships Preussen and Lothringen, the light cruisers Nymphe and Niobe, four destroyers and four torpedo boats. No submarines are allowed by the Treaty.

The Fleet is maintained on a voluntary basis, and the total personnel may not exceed 15,000, including a maximum of 1500 officers and warrant-officers, who enter for a consecutive period of twenty-five years, petty officers and men entering for twelve years. Recruiting has been progressing under a decree signed by the Minister of Defence and the Chief of the Admiralty, September 3, 1919.

Some changes have been made in the uniforms, the wearing of which is obligatory only on duty. The ranks of officers and warrant-officers are now shown by stripes differing in number and width on the sleeve, and epaulettes have been done away with. Great-coats have shoulder-straps bearing the badges of rank. The letters "S.M.S." have disappeared from the capbands of the men, and the name of the ship alone remains. Gilt buttons without the crown are used, and the dagger is the only weapon carried.

RUSSIA.

For information concerning the Russian Fleet, as controlled by the Soviet Government in the Baltic and the Government of General Wrangel in the Black Sea, refer to a statement included in the account of "The Lesser Navies," on page 270. The vessels which have been fighting in the Caspian are chiefly armed and converted merchantmen, with some torpedo craft.

NORWAY.

There is little change to report in the Norwegian Navy. The cessation of war has made possible a reduction of the period of service of the conscripts in the fleet from twelve months to six. The gunboat Viking, a depôt ship, twelve old torpedo boats, and two patrol boats have been scrapped or placed on the sale list. The future naval policy of the country will be shaped by the lessons of the war and the new international situation. A Committee of Defence has been appointed to investigate the position, and to report on the future character, strength, and organisation of the naval and military forces. The problem presented to the Northern Powers is complex, but they are tending to the construction of a limited number of coast-defence ships, and of destroyers and submarines, and to the provision of a large equipment of mining material.

SWEDEN.

On July 1st the Ministries of Naval and Military Defence were brought together under a single Minister of War. This arrangement has been made with the object of securing close co-operation, and is not held to imply that the Swedish Navy is now subject to the Army. Although the present Minister is a civilian, there is nothing to prevent his successors from being naval or military officers directing both branches of the service.

A commission of naval officers has been appointed to report to the Government on the future naval policy of Sweden. No additions are at present being made to the Fleet, except in the matter of small craft, principally submarines, and over the latter a veil of secrecy is cast, so that no particulars are available.

The armoured cruiser Drottning Victoria is approaching completion. Like her sister the Sverige, she will have two Westinghouse turbines (22,000 S.H.P.), each of two units, driving two propellers through "floating frame" reduction-gears, the steam being so directed by "divided flow" that all four units can be used at full speed, and the high-pressure units alone at cruising speed.

DENMARK.

During the war Denmark was in a difficult position between the Allies on the one hand, and Germany on the other, but the vigilance of her Navy enabled her to maintain her neutrality. The small but efficient Fleet was employed in controlling navigation in the Belts of her territorial waters, in convoy, in keeping her minefields efficient, and in sweeping up floating mines, of which in all about 16,000 were destroyed, the lives of many brave seamen having been lost in the dangerous work.

With regard to the present policy of the country, Denmark is continuing to build small coast-defence ships, destroyers of moderate dimensions, submarines, and flying boats. She is reported to be maintaining a supply of mines sufficient for any future need.

THE NETHERLANDS.

The future naval policy of the Netherlands is under consideration by a Fleet Committee, which, at the time of writing, has not made its report. Meantime the Government has given publicity to its view. Following upon an attack on the Navy by the disarmament party, a preliminary report was made by the First Chamber, to which the Government replied in a memorandum dated May 22nd. The memorandum stated that to consider the question of disarmament would be premature in present circumstances. The Fleet is indispensable for the preservation of the independence of the country. To build a great fleet would, however, be beyond the resources of the Netherlands, and it is not considered to be necessary. The defence must be maintained by a force of destroyers, submarines, minelayers, aeroplanes, and coast-defence vessels. In addition, for the defence of the colonies, a few light cruisers would be required, and the Government therefore strongly insisted that the construction should be continued of the cruisers Java and Sumatra, which are expected to be commissioned within three years. The naval and military departments will, it is understood, be brought under a single minister, a service officer commanding the naval department.

LESSER BALTIC POWERS.

The Esthonian Navy, which played its part in asserting the independence of the country, has received the addition of the late Russian gunboat Bobr, 875 tons, while the sister vessel Gilyak has gone to Finland. Latvia, which has about 340 miles of coast line and the harbours of Riga, Libau, and Windau, proposes the creation of a small Navy under the Minister of National Defence. Poland is also organising, and has received the advice at her own request of a small British Naval Commission on some preliminary work.

CHILE.

The Chilean Navy has been reconstituted by the repurchase from Great Britain of the battleship Almirante Latorre (28,000 tons, ten 14-in. guns), launched at Elswick in 1913, which was requisitioned for the British Service at the outbreak of the war, and received the name of Canada. She was in the Third Division at the Battle of Jutland, under command of Capt. W. C. M. Nicholson. Three powerful flotilla leaders which were building for Chile at Cowes in 1914, were taken over, and rendered fine service under the names of Botha, Broke, and Faulknor. These have been refitted for the Chilean service, and named Almirante Riveros, Almirante Uribe, and Almirante Williams. A brig named the Stoic accompanied them across the Atlantic. The sloops Leucoton, Elicura, Colocolo, and Orompello were refitted at Cowes after their active service in European waters during the war preparatory to their return home.

PERU.

It was believed that Peru, stimulated by the Tacna and Arica Question, and the agitated dispute with Chile, would do something to add to her inconsiderable naval defences. But up to the time of writing nothing has been done, and no programme has been taken into consideration. It appears that the finances of the country do not encourage any considerable naval effort.

BRAZIL.

No additions are being made to the Brazilian Navy at the present time. Some of the older ships have been scrapped. A naval programme seems to be contemplated, the estimates providing for some studies or inquiries with that object in view. A committee was appointed to report upon the naval arsenal and bases, and some small provision has been made for additions to the works already undertaken at the Ilha das Cobras for the Navy Yard at Rio de Janeiro. Reforms are intended with regard to the personnel, more especially touching education, and fresh regulations have recently been issued for the training of naval cadets.

ARGENTINA.

No additions have been made to the fighting strength of the Argentine Navy, but the fleet of transports (now numbering fourteen) received in 1917, the accession of the Luis A. Huergo and Aristóbulo del Valle, 7200 and 5400 tons, built at Fore River and Great Lakes, U.S.A. Two old transports were reconstructed in 1918 and 1919, Rio Negro and Patagonia.

TURKEY.

In accordance with the provisions of the Turkish Peace Treaty, Part V., the Ottoman Navy is abolished. The tables which have so long appeared in the "Naval Annual," with successive alterations, are therefore omitted in this issue, and Turkey now falls to the rank of a Minor Power possessing no ships of effective value except for police purposes.

ROUMANIA.

It has been stated that Roumania would add to her programme further monitors for the Danube, but so far nothing has been done. The acquisitions of 1920 are two destroyers built at Naples, which were ordered before the war, and four gunboats, described as submarine chasers, which have been bought from the French Navy.

JUGO-SLAVIA.

The cession of the former Austro-Hungarian Fleet to the Jugo-Slav National Council at Agram was recorded in last issue of the "Annual," as also was the manner in which the Allies relieved of their charge the Slav officers who had taken possession of the ships. It appears that the southern Slavs in the ships acted with the support of the Poles and Czechs in the Fleet, and offered hospitality to the German-Austrians and Hungarians until such time as they could return to their own countries. The kingdom of the Serbs, Croats, and Slovenes will have a small number of vessels for coast work and the protection of the fisheries. An arrangement has been made for the return to the owners of a considerable tonnage of their mercantile marine.

JOHN LEYLAND.

CHAPTER III.

COMPARATIVE TABLES.

PARTICULARS are now available, as they have not been fully available since 1914, for a survey of the comparative strengths of the principal navies, revealing not only their present standing but the tendencies of policy which must become apparent during the next few years. The principal ex-enemy men-of-war have been distributed amongst the Allied and Associated Powers—mostly on condition that they are to be broken up *—and the Russian fleet has suffered paralysis and decay, with the result that the number of principal navies, which before the war stood at eight, has been reduced to five. Of those Powers which still maintain fleets of considerable size only two, the United States and Japan, are now engaged in building capital ships. No battleship or battle-cruiser has been laid down in the United Kingdom since the Hood was begun in 1916—the year of the Battle of Jutland, which threw fresh light on many problems of naval construction and armament. The battleships which were being built in France and Italy on the eve of the war have since been abandoned.

The usual comparative tables, which have been a feature of the "Annual" for many years, show that only three of the navies of which particulars are given can now be regarded as belonging to the first class so far as the heaviest ships are concerned. The decline of France and Italy, in this respect, is directly traceable to the preoccupation of these countries during the war in supporting their armies. The British Fleet occupies at the moment a pre-eminence, so far as European Powers are concerned, more conspicuous than at any previous date, and it also ranks ahead of the navies of the United States and Japan.

The tabular statement on the following page reveals the strength in effective fighting ships, built and building, of the principal naval Powers.

The heaviest gun mounted in the British Fleet is the 15-in. weapon of 42 calibres, the Hood alone mounting 15-in. guns of 45 calibres. On the other hand, all the sixteen capital ships under construction in the United States will carry 16-in. guns; in four vessels these are of 45 calibres, but the rest of the ships will have 16-in. guns of 50 calibres. It was anticipated that the American programme of construction, which includes light cruisers, destroyers,

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* See Chapter XI.

and submarines, as well as capital ships, would be completed in 1923. There is reason to anticipate that, owing to the delays which have already occurred and are still persisting, the battleships and battle-cruisers will not all be ready until 1924. In that year the American fleet will be stronger than it is to-day by ten battleships and six battle-cruisers, mounting an aggregate of 152 16-in. guns. The battleships have been designed for a speed of 21 knots in the case of four vessels, and 23 knots in the case of the others; the battle-cruisers are to steam at 33¼ knots. No capital ships, since none are now building, will, on the other hand, be added to the British or other European fleet during the next four years. The progress which will be made with the Japanese programme is uncertain, but probably two battleships and two battle-cruisers will be completed.

EFFECTIVE FIGHTING SHIPS, BUILT AND BUILDING.

Class.	GREAT BRITAIN.			UNITED STATES.			FRANCE.			ITALY.			JAPAN.		
	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.
Battleships, 14" and upwards ...	14	—	14	11	10	21	—	—	—	—	—	—	4	4	8
Battle-cruisers, 14" and upwards ...	4	—	4	—	6	6	—	—	—	—	—	—	4	2	6
Battleships, smaller guns	14	—	14	8	—	8	10	—	10	5	—	5	3	—	3
Battle-cruisers, smaller guns ...	4	—	4	—	—	—	—	—	—	—	—	—	—	—	—
Light cruisers ...	62	7	69	3	10	13	11	—	11	20	2	22	10	3	13
Destroyers	190	—	190	287	30	317	88	—	88	50	—	50	99	—	99
Submarines	98	—	98	100	66	166	36	4	40	39	—	39	13	—	13

During the period when the United States and Japan are pushing forward their programme, a considerable number of the heavy ships which now are in reserve in European and other navies, will have become obsolete, owing, in the main, to their being unable to withstand punishment from the more powerfully armed vessels of more recent construction, but, in part, to their smaller radius for cruising. A large proportion of the "Battleships with Smaller Guns" (Table III.), as well as the battle-cruisers in Table IV., will have been broken up by 1924, and small fighting value will attach to the remainder.

In the next few years the British Fleet will lose its supremacy unless either foreign construction be delayed or a programme of new shipbuilding be undertaken in this country. We possess only one capital ship, the Hood, designed after the opening of the war, and though some alterations were made in the design of this vessel after the Battle of Jutland, she does not embody, in a full sense, the dearly bought experiences of the war. The British strength in battleships is perhaps unduly exaggerated by including in Tables I.

and II. the four ships of the Iron Duke class and the Tiger respectively. They carry only 13·5-in. guns, but those weapons are of a heavier and more powerful type than the earlier 13·5-in. guns mounted in other British ships, and are only slightly inferior to the 14-in. guns of the American and Japanese navies as regards weight of projectile.

It is generally admitted that the displacement of ships of contemporary design supplies a fairly reliable index to their fighting power. If this test be applied to Table I., it must become evident that the decline of the fighting power of the British Fleet, which must take place in the next few years, will be so marked as to justify anxiety as to our future on the sea. In 1924 we shall possess only 14 first-class battleships of 366,350 tons to the 21 of 722,000 tons under the American flag, while Japan will have 8 of 252,000 tons; we shall have only 4 battle-cruisers, with the heaviest guns, of 121,000 tons to the 6 of the United States of 261,000 tons; and the Japanese may possibly have a similar number completed in that year. The Japanese Government has, moreover, decided to lay down 8 more capital ships at an early date. In view of all these circumstances, and bearing in mind that only one capital ship for the British Fleet, apart from the lightly armoured Renown and Repulse, with 6-in. belts only, has been built since 1914, the outlook is one which can give no satisfaction to those who realise the essential functions which British heavy ships—whether battleships or battle-cruisers—may be called upon to perform.

In the light cruiser class Great Britain maintains her predominance, but at least two nations are following her lead in the construction of fast, well-armed vessels of this type, the importance of which was so fully demonstrated during the war. In destroyers and submarines the United States has obtained a lead which will be further accentuated when the craft now under consideration are completed.

THE EDITORS.

TABLE I.—BATTLESHIPS WITH 14-IN. GUNS AND UPWARDS.

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY.			UNITED STATES.		
Launched.	Name	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.
		tons.			tons.									tons.
1915	Royal Sovereign	25,750		*Tosa*	32,000								*Indiana*	43,200
1914	Royal Oak		1919	*Mutsu*									*Iowa*	
1915	Revenge		1919	*Nagato*									*Massachusetts*	
1915	Resolution			*Kaga*									*Montana*	
1916	Ramillies		1914	Fuso	31,000								*North Carolina*	
1915	Malaya	27,500	1915	Hyuga									*South Dakota*	
1914	Barbam		1916	Ise									*West Virginia*	32,600
1913	Queen Elizabeth		1915	Yamashiro									*Washington*	
1913	Warspite												*Colorado*	
1914	Valiant											1920	*Maryland*	
1912	Iron Duke	25,000										1919	California	32,300
1912	Marlborough											1917	Tennessee	
1913	Emperor of India											1917	Idaho	32,000
1913	Benbow											1917	Mississippi	
												1915	New Mexico	
												1915	Arizona	31,400
												1914	Pennsylvania	
												1914	Nevada	27,500
												1912	Oklahoma	
												1912	New York	27,000
												1911	Texas	
	14 ships.	366,250		8 ships.	252,000								21 ships.	722,000

TABLE II.—BATTLE-CRUISERS WITH 14-IN. GUNS AND UPWARDS.

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY.			UNITED STATES.		
Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.
		tons.			tons.									tons.
1918	Hood	41,200		*Akagi*	38,000								*Constellation*	43,500
1916	Renown	25,750		*Amagi*									*Constitution*	
1916	Repulse		1916	Kirishima	27,500								*Lexington*	
1913	Tiger	28,500	1913	Kongo									*Ranger*	
			1915	Haruna									*Saratoga*	
			1915	Hiyei									*United States*	
	4 ships.	121,200		6 ships.	186,000								6 ships.	261,000

TABLE III.—BATTLESHIPS WITH SMALLER GUNS.

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY.			UNITED STATES.		
Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.
		tons.			tons.			tons.			tons.			tons.
1913	Erin	29,940	1911	Settsu	20,800	1913	Bretagne	23,177	1913	Andrea Doria ...	23,562	1911	Arkansas	26,000
1911	King George V....	23,000	1807	Aki	19,800	1913	Lorraine		1911	Caio Duilio ...		1910	Wyoming	
1911	Centurion		1906	Satsuma	19,350	1912	France	23,100	1911	Conte di Cavour...	22,023	1909	Florida	21,825
1912	Ajax					1912	Paris		1911	Guilio Cesare ...		1909	Utah	
1910	Orion	22,400				1911	Courbet		1910	Dante Alighieri...	19,400	1908	Delaware	20,000
1911	Conqueror					1911	Jean Bart					1908	North Dakota ...	
1911	Monarch					1909	Condorcet	18,000				1908	Michigan	16,000
1911	Thunderer					1909	Diderot...						South Carolina ...	
1910	Colossus	20,000				1910	Vergniaud							
1910	Hercules					1909	Voltaire							
1909	Neptune	19,900												
1908	Collingwood ...	19,250												
1908	St. Vincent ...													
1907	Temeraire	18,600												
	14 ships.	305,540		3 ships.	59,950		10 ships.	210,754		5 ships.	110,570		8 ships.	167,650

TABLE IV.—BATTLE-CRUISERS WITH SMALLER GUNS.

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY.			UNITED STATES.		
Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.	Launched.	Name.	Displacement.
		tons.												
1911	Princess Royal ...	26,350												
1910	Lion													
1911	New Zealand ...	18,800												
1911	Australia*													
	4 ships.	90,300												

* Royal Australian Navy.

TABLE V.—LIGHT CRUISERS.

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY.			UNITED STATES.		
Speed.	Name.	Displace-ment.	Speed.	Name.	Displace-ment.	Speed.	Name.	Displace-ment.	Speed.	Name.	Displace-ment.	Speed.	Name.	Displace-ment.
kts.		tons.	kts.		tons.	kts.		tons.	kts.		tons.	kts.		tons.
32	Courageous *	18,600	36	*Kiso*	5,500	22	Jurien de la Gravière	5,690	34	*Leone*	1,985	35	10 *building*, Nos. 4 to 13	7,100
32	Glorious *		36	*Kuma*		23	Guichen	8,282	34	*Tigre*		24	Birmingham ...	3,750
33	*Enterprise*	7,750	36	*Tama*		20	D'Estrées	2,460	32	Alessandro Pocrio	1,012	24	Chester...	
33	*Emerald*		31	Tatsuta...	3,500	19	Cassard...	3,890	32	Guglielmo Pepe ..		24	Salem	
30	*Effingham*	9,750	31	Tenryu...		19	D'Entrecasteaux...	8,123	32	Pantera...				
30	*Frobisher*		26	Hirato	4,950	20	Du Chayla	3,957	35	Aquila	1,500			
30	Hawkins		26	Chikima					35	Augusto Riboty ...				
30	Raleigh		26	Yahagi			*ex-Enemy Ships.*		35	Carlo Mirabello ...	1,476			
29	*Despatch*		23	Tone	4,035		*ex*-Königsberg ...	4,200	35	Falco	1,460			
29	*Diomede*	4,650	20	Niitaka...	3,420		*ex*-Regensburg ...	4,842	28	Quarto	3,220			
29	Danae		20	Tsushima			*ex*-Stralsund ...	4,480	28	Marsala	2,400			
29	Dauntless		20	Tsugaru	6,630		*ex*-Kolberg	4,280	28	Nino Bixio	3,400			
29	Dragon		22½	Chitose	4,992		*ex*-Novara	3,500	16½	Campania	2,460			
29	Delhi								16½	Calabria	2,452			
29	Dunedin								22	Libia	3,690			
29	Durban...								19½	Liguria...	2,245			
29	Cairo	4,190												
29	Calcutta									*ex-Enemy Ships.*				
29	*Cape Town*									*ex*-Graudenz ...	4,842			
29	Carlisle...									*ex*-Pillau	4,320			
29	Colombo									*ex*-Strassburg ...	4,480			
29	Caledon	4,120								*ex*-Helgoland ...	3,500			
29	Calypso									*ex*-Saida	3,500			
29	Caradoc...									*ex*-V116(Premuda)	2,500			
29	Cambrian	3,750												
29	Canterbury													
29	Castor													
29	Constance													
29	Cardiff	4,190												
29	Ceres													
29	Coventry													
29	Curacoa													
29	Curlew													
29	Centaur	3,750												
39	Concord													
25	Birkenhead	5,250												
26½	Chester													

* These vessels, as their displacement reveals, are ships of a special class, but they are only lightly protected.

TABLE V.—LIGHT CRUISERS (*continued*).

GREAT BRITAIN.			JAPAN.			FRANCE.			ITALY			UNITED STATES.		
Speed.	Name.	Displacement.	Speed.	Name.	Displacement.	Speed.	Name.	Displacement.	Speed.	Name.	Displacement.	Speed.	Name.	Displacement.
kts.		tons.	kts.		tons.	kts.		tons.	kts.		tons.	kts.		tons.
29	Calliope	3,750												
29	Conquest													
29	Cordelia													
29	Carysfort													
29	Cleopatra													
29	Comus													
29	Caroline													
29	Champion													
29	Aurora‡	3,500												
29	Galatea...													
29	Inconstant													
29	Penelope													
29	Phaeton													
29	Royalist													
29	Undaunted													
26	Birmingham ...	5,400												
26	Lowestoft													
25½	Chatham†	5,400												
25½	Dublin													
25½	Southampton ...													
25½	Adelaide*													
25½	Brisbane*													
25½	Melbourne*... ...													
25½	Sydney*													
25½	Dartmouth	5,250												
25½	Weymouth													
25½	Yarmouth													
25	Bristol	4,800												
25	Glasgow													
25	Gloucester													
25	Liverpool													
25	Newcastle													
	69 ships.	359,010		13 ships.	60,847		11 ships.	53,704		22 ships.	56,951		18 ships.	82,250

* Royal Australian Navy. † New Zealand Naval Force. ‡ Royal Canadian Navy.

CHAPTER IV.

THE CAPITAL SHIP OF THE FUTURE.

NAVAL design, perfected during many years of peace, had developed various types of vessels to cope with possible contingencies estimated likely to occur in actual warfare, and these, with but slight modifications, held the field up to the beginning of the world war. All programmes and all navies, whatever the units employed in their composition, accepted the capital ship as the most valuable unit, and as it is impossible within the limits of this chapter to deal with all the components of a fleet, it is mainly limited to the future of the capital ship itself.

Throughout the war, which covered a period of nearly four and a half years, German submarines sank a good many of His Majesty's ships, but they were most of them obsolescent and slow. They destroyed, on the other hand, no unit of the Battle squadron of the Grand Fleet. The Grand Fleet, for the protection of which adequate precautions were adopted, was still intact when the struggle closed. In introducing the Navy Estimates for 1920–21, the First Lord of the Admiralty remarked: "We have been told in some quarters that the day of the capital ship is over. All I can say is that, in the first place, that is not the view of my naval advisers at the Board of Admiralty, and it is not the view, so far as I can find out, of any other great naval country. . . . My naval advisers are satisfied that the big ship, if you unhappily ever came to war, would prove again, as it has proved before, to be the predominant factor in naval warfare, and that in the end the weight of metal would tell, and that therefore the big ship must, at all events for some time to come, be preserved as an important part of our naval equipment."

As the First Lord's statement suggests, a fleet does not, however, consist only of capital ships.

In his latest book "The Crisis of the Naval War," Admiral of the Fleet Viscount Jellicoe discusses the two types of ships by which the vessels of the British Navy might be opposed in any future contest, and, after urging that "it is necessary for us to be in a position of superiority in all the weapons by which their safety may be endangered," he declares that the war has shown how to insure safety against vessels which move under the water as well as against vessels which move on the surface. Finally, Grand Admiral von Tirpitz in his reminiscences of the war says, "In all essentials a naval battle is a fight of one ship against another; the decisive technical factor is rather the concentration of force in the individual ship than the actual number of ships." These quotations suggest that there is a widespread agreement that the capital ship is not dead.

The capital ship cannot be discussed entirely apart from the submarine, the influence of the latter in modern naval warfare having been the determining factor of some of the qualities embodied in the latest type of surface ships. In place of the theory of pre-war days we have the results of several years of actual war experience, and the subject may now be approached with much increased knowledge and with assumptions made with a fair degree of justification.

THE CHANGES IN BATTLESHIP DESIGN.

It will be necessary to review the changes which have taken place in capital ship construction since the introduction of the "Dreadnought" in order to show the influence of submarines on the surface ship and indicate the possibilities of their further development. It is desirable also to analyse the tactical offensive and defensive requirements of the big-gun ship before suggesting the probable direction of its future development. The papers contributed by Sir Philip Watts and Sir Eustace d'Eyncourt to the Transactions of the Institution of Naval Architects, 1919 and 1920, afford material assistance in dealing with the problem. Importance attaches especially to the paper relating to H.M.S. Hood. The design for this vessel was prepared in 1915, and embodied the latest British Admiralty ideas respecting under-water protection, speed, etc. After the Battle of Jutland the design was modified to embody greater protection, based on the experience of that battle. In any forecast of the future capital ship the qualities of H.M.S. Hood must be given due consideration. Particulars of the Hood will be found in the table on page 77, and plans and sections are given on Plate I., and the main features are shown in the comparison of the various classes of British capital ships in the table on page 72.

An examination of the principal dimensions and legend displacements of the battleships under review shows immediately that, for British practice, the displacement of the battleship varies almost exactly with the principal dimensions, or, in other words, the block coefficient of this type of ship has remained practically constant since the introduction of the "Dreadnought" class. Thus, based on dimensions of the Iron Duke designed in 1910–1, the displacement of the Hood $= \frac{810 \times 104 \times 28{\cdot}5}{580 \times 90 \times 28} \,.\, 25{,}000 = 41{,}250$. The actual figure given by Sir Eustace d'Eyncourt was 41,200 tons. The constancy of that relation simplifies considerably our investigation of the problem of the future development of the type. On the other hand, each of the principal dimensions, viz. length, breadth, draught, does not vary in the ratio of the cube roots of the displacements. With the very large increase in displacements during the selected period the normal draught has increased from 26 ft. 6 in. to 28 ft. 6 in. The slight variation in this factor has a very appreciable influence on the designs of the larger vessels, and should be given proper consideration in a detailed analysis of the chief characteristics of the capital ship. Its immediate result is that, with constant block coefficient and varying displacement, the lengths and breadths of the ships are each increased beyond the ratio given by their relation to the cube roots of the displacements; hence with fixed ratio of protection to displacement the protective material must be distributed over a proportionately larger area with consequent diminution of thickness.

PARTICULARS OF SUCCESSIVE BRITISH BATTLESHIPS.

Items.	"Orion" Class.	"Iron Duke" Class.	"Queen Elizabeth."	"Royal Sovereign."	"Hood."
Date of launch	1910	1912	1913	1915	1918
Length between perpendiculars	545′ 0″	580′ 0″	600′ 0″	580′ 0″	810′ 0″
Length overall	—	622′ 9″	643′ 9″	624′ 3″	860′ 0″
Breadth	88′ 6″	90′ 0″	90′ 6″	88′ 6″	104′ 0″
Load draught, mean	27′ 6″	28′ 0″	28′ 9″	28′ 6″	28′ 6″
Displacement in tons	22,500	25,000	27,500	25,750	41,200
S.H.P.	27,000	29,000	75,000	40,000	144,000
Fuel at load draught	—	900	650	900	1200
Coal capacity (tons)	—	3250	—	—	—
Oil fuel capacity (tons)	—	1050	3400	3400	4000
Armament	10 13·5-in. 13 4-in.	10 13·5-in. 12 6-in.	8 15-in. 14 6-in.	8 15-in. 14 6-in.	8 15-in. 12 5·5-in.
Armour :—					
Amidships	12″	12″, 9″, 8″	13″, 6″	13″, 6″	12″, 7″, 5″
Gun positions	11″	11″ & 10″	11″ & 10″	11″ & 10″	15″, 12″, 11″
Speed in knots	21	21	25	23	31

Items of interest in British capital ship construction are:—

(1) With the exception of the "Queen Elizabeth" class, the speed remains practically constant over the pre-war period.

(2) In H.M.S. Hood the speed reaches the very high figure of 31 knots.

(3) The primary armament of the "Dreadnoughts" had advanced from 12 in. – 45 cal. guns to 15 in. – 42 cal. guns previous to 1914.

(4) The big guns of the Hood do not exceed the maximum diameter of pre-war days.

BRITISH BATTLE-CRUISERS.

So far we have considered only those vessels which are usually classified as battleships, although some writers place the Hood in the battle-cruiser class, and from the point of view of speed only, that is probably the more correct classification. It will, however, be seen later that the percentage distribution of the tactical offensive and defensive factors undoubtedly place her in the battleship class. To "the man in the street" the distinction between the two classes has been mainly one of speed, but with the Hood at 31 knots and the Tiger at 30 knots, it is evident that that distinction has completely broken down. It is impossible, therefore, to exclude from our consideration the battle-cruiser class, since the manner of distribution of the factors mentioned above not only forms the real basis for the selection of the class, but also goes to determine the ultimate type of capital ship. The following table indicates the line of development of those big-gun ships forming the battle-cruiser class:—

PARTICULARS OF BRITISH BATTLE-CRUISERS.

Items.	Invincible.	Lion.	Tiger.	Renown.	Courageous.
Date of launch	1907	1910	1913	1916	1916
Length between perpendiculars	530′ 0″	660′ 0″	660′ 0″	750′ 0″	735′ 0″
Length overall	567′ 0″	704′ 0″	704′ 0″	794′ 0″	786′ 3″
Breadth	78′ 6″	88′ 6″	90′ 6″	90′ 6″	81′ 0″
Load draught, mean	26′ 0″	28′ 0″	28′ 6″	25′ 6″	22′ 3″
Displacement in tons	17,250	26,350	28,500	26,500	18,600
S.H.P.	41,000	70,000	108,000	112,000	90,000
Speed in knots	25·5	28	30	32 nearly	32
Fuel at load draught	—	—	900	1000	750
Coal capacity in tons	—	—	3320	—	—
Oil fuel capacity in tons	—	—	3480	4250	3250
Armament	8 12-in. 16 4-in.	8 13·5-in. 16 4-in.	8 13·5-in. 12 6-in.	6 15-in. 17 4-in.	4 15-in. 18 4-in.
Armour:—					
Amidships	6″	9″	9″, 6″, 5″	6″, 1½″	3″
Gun positions	7″	9″	9″	11″, 7″	9″, 7″

GERMAN CAPITAL SHIPS.

Let us now pass to the battleships of our recent principal adversary. It will be observed from the subjoined table that until we reach the "Bayern" class the type of armament remains constant; in fact, there is a reduction in the number of big guns in passing from the "Helgoland" class to the two following classes. Further, the S.H.P.s have not been subjected to appreciable change, and in certain cases even show reductions. The importance of these two points will be realised more fully after detailed analysis, but should be particularly noted at this stage. Thus, the tactical and offensive factors remained practically constant, which admitted of the increased

PARTICULARS OF GERMAN BATTLESHIPS.

Items.	"Bayern" Class.	"Konig" Class.	"Kaiser" Class.	"Helgoland" Class.	"Nassau" Class.
Date of launch	1915	1913	1911	1909	1908
Length	626′ 8″	573′ 2″	564′ 4″	546′ 3″	478′ 0′
Breadth	100′ 0″	96′ 9″	95′ 2″	93′ 6″	88′ 3″
Draught	28′ 0″	27′ 3″	27′ 3″	26′ 11″	26′ 7″
Displacement	28,050	25,390	24,310	22,440	18,600
Speed in knots	23	23	22·3	21	20
S.H.P.	56,000	31,000	31,000	31,250	27,500
Primary guns	8 15-in.	10 12-in.	10 12-in.	12 12-in.	12 11-in.
Armour, W.L. belt	15″ (?)	14″	13¾″	11¾″	11¾″
Side above W.L. belt	—	10″	9″	7¾″	7¼″
Primary gun positions	—	14″	11¾″	11¾″	11″

displacement being entirely devoted to armour and protection. Unfortunately, few particulars have been published of the "Bayern" class, and analysis proves that some of these are incorrect. Taking all things into consideration, the figures given above appear to be only approximately correct. They show, however, that while the Germans passed from the 12-in. to the 15-in. gun of our "Queen Elizabeth" class, they accepted a reduced speed for the purpose of retaining good defensive qualities. It is unnecessary to review the German battle-cruisers as the distribution of weight in the later types over the principal factor approximates very closely to British practice.

U.S. CAPITAL SHIPS.

Progress in the big-gun ship of the U.S. Navy is shown for the principal items in the following table, included in which will be found particulars of the "Lexington" class of battle-cruiser. Very few details of this type have been published to date; but the available dimensions are given in the table on page 79. In the first three classes, the distribution of weight is practically the same; the main armament of the "Maryland" class has been increased in calibre, but the number of guns has been reduced in comparison with the other two classes, the weight devoted to armament remaining practically constant. For the latest battleships and the battle-cruisers the table is incomplete, but our later analysis will show the effect of the changes on the defensive qualities of these designs.

PARTICULARS OF U.S. BATTLESHIPS.

Items.	"New Mexico" Class.	"California" Class.	"Maryland" Class.	"Massachusetts" Class.	"Lexington" Class.
Date of launch . .	1917				
Length W.L. . .	600′	600′	600′	660′	850′
Breadth	93¾′	97·29′	97·29′	104·75′	90′
Draught	30′	30′	30′ 6″	33′	31′ 3½″
Displacement . .	32,000	32,300	32,600	43,200	35,300
Speed, knots . .	21	21	21	23	—
S.H.P.	34,000	34,000	34,000	60,000	185,000
Primary guns . .	12,14″-50	12,14″-50	8,16″-45	12,16″-50	8,16″-50
Armour, W.L. belt .	14″	14″	16″-14″	—	—
Side above W.L. belt	—	—	—	—	—
Primary gun positions	18″, 9″	18″, 9″	18″, 9″	—	—

BRITISH SUBMARINE BOATS.

As the submarine has undoubtedly affected to a large extent the design of the capital ship and, depending on its evolution, will probably continue to do so in even greater measure, it is necessary here to indicate to some extent its advance and present position. Excluding for this purpose heavily armed submarines with guns suited to capital ships, which are never likely to be called upon to take part in a naval action, and considering only those submarines armed purely with a torpedo and a light gun armament, and therefore, given favourable conditions, capable of sinking a capital ship, and taking the "H" class as a basis, as being of reasonable dimensions and armament, we find that to pass from her type to the splendid "K" boats, with their 24 knots surface speed and eight torpedo tubes, involves an increase of 1440 tons and an increase of shaft horse power of 9520, the leading particulars of the two types being as given in the following table. This table shows very clearly the effect of increasing size. Increase in armament is slow and out of proportion to the increase in displacement. The greatest advance is to be found in the surface speed, and, what is most important at the moment, these changes are accompanied by a falling off in the under-water speed. In other words, no progress appears possible in the running qualities of the submarine as a surface ship without a corresponding sacrifice in those same qualities when the vessel is submerged and exercising those functions for which she was designed. When the aim of the naval tactician and the naval designer is to produce a submersible capable of operating with a battle-fleet it can only be done by increasing the surface speed.

Items.	"H" Class.	"K" Class.
Length overall	171′ 0″	338′ 0″
Surface displacement in tons	440	1880
S.H.P. (surface)	480	10,000
Speed (surface)	13 knots	24 knots
,, (submerged)	10½ ,,	9 ,,
Guns	—	1 4-in., 1 3-in. H.A.
Torpedo tubes	4 21-in.	8 18-in.

The Submarine as a Surface Ship.

As a surface ship the submarine must, necessarily, be very inefficient in comparison with the destroyer of similar displacement, as the annexed table shows. The fourth column

Comparison of Submarines with Typical British Destroyers.

Items. (1)	"Scott" Class (destroyer). (2)	"K" Class (submersible). (3)	30 knot. (submersible). (4)
Length B.P.	320′ 0″	334′ 0″	500′ 0″
Length overall	332′ 6″	338′ 0″	490′ 6″
Breadth, extreme	31′ 9″	26′ 6″	45′ 0″
Load draught, mean	10′ 6″	16′ 0″	22′ 6″
Displacement in tons	1800	1880	5450
S.H.P.	40,000 to 44,000	10,000	50,000
Speed at load draught, knots	36	24	30
Fuel at load draught, tons	250	—	—
Oil fuel capacity, tons	500	200	545
Armament	5 4·7-in. 1 3-in. H.A. 6 21-in. T.T.	1 4-in. 1 3-in. H.A. 8 18-in. T.T.	1 5·5-in. 1 3-in. H.A. 6 21-in. T.T.

gives approximate dimensions and other particulars for a submarine capable of attaining a speed of 30 knots on the surface, and, therefore, of forming one of the units of a high-class battle-fleet. The very large size and displacement to which it is necessary to pass in order that a speed of 30 knots might be guaranteed, indicate further the economical disadvantages of submarines of high surface speed, and these do not represent the total, for the submerged speed now drops to about 7½ knots. Again, the difficulty in handling a 500-ft. vessel as a submersible must be apparent even to the ordinary observer when it is stated that the depths of water in the North Sea vary from 40 fathoms off the Firth of Forth to 16–18 fathoms off the mouth of the Thames. The tactical difficulties in manœuvring a vessel of these dimensions into a favourable position for attack without observation by the enemy would cause much anxiety to its commander, as with its slow submerged speed and huge target it is helpless against the depth charges of the 36-knot destroyer. How much more difficult then would be the handling of a large submersible battleship about which mention has been made lately in technical papers and in the Admiralty Memorandum! It is practically certain that, apart from its questionable value as an efficient fighting unit, the dimensions of an unarmoured submersible with armament and speed equal to that of a modern capital ship would be such that even the most advanced naval expert would hesitate to accept responsibility for its recommendation.

THE UTILITY OF THE CAPITAL SHIP.

Much of the controversy respecting the utility of the capital ship has been based on its vulnerability with regard to submarine attacks. Recent developments appear, however, to put some limitations to the power of the submarine in this respect, and to make it difficult for her to keep pace with the advance of the capital ship. There is always a possibility, however, of engineering difficulties being overcome and of it becoming possible to use powerful engines of the type used for speed on the surface for submerged running, and to neglect this possibility in designing the capital ship would be folly. Destroyers also must be taken into account when dealing with the design of the capital ship. In the Battle of Jutland they took a very active part and, according to Commander von Hase of the Derfflinger, the British destroyers succeeded in throwing the German line into disorder. The writer's opinion is that future sea battles will find the destroyers, as in this war, mainly concerned with the protection of the capital ship against submarine attacks, but that they will eventually have larger dimensions, higher speed, and improved torpedoes of higher explosive capacity, and will approach in size or replace the light-cruiser class.

Having shortly digressed from an examination of the capital ship to consider units intimately affecting her design, it becomes necessary to examine the features entering into the composition of the capital ship herself, and to ascertain the distribution of weight over the three principal factors of fighting efficiency, namely, armament, protection, and speed, for it is the manner of that distribution that chiefly determines the classification and fighting value of the vessel.

The table on this page has in part been taken from Sir Eustace d'Eyncourt's 1919 paper, but certain types have been omitted, and the figures given for the Hood in 1920 have been included.

Disposition of Weight (Percentage of Total Legend Displacement) in British Capital Ships.

No.	Item.	Hood (1919).	Queen Elizabeth.	Iron Duke and Royal Sovereign.	Lion.	Renown.	Courageous.
1.	Equipment .	2·0	3·0	3·0	3·0	2·5	3·5
2.	Armament . .	12·5	16·5	18·0	12·5	12·5	12·0
3.	Machinery . .	13·0	14·5	10·0	20·0	21·0	16·0
4.	Fuel (legend) .	3·0	2·5	3·5	4·0	3·5	4·0
5.	Armament and protection .	33·5	31·0	32·0	23·5	21·5	18·5
6.	Hull . . .	36·0	32·5	33·5	37·0	39·0	46·0
7.	Sum of items 2, 3, 5 . .	59·0	62·0	60·0	56·0	55·0	46·5
8.	Sum of items 2 and 5 . .	46·0	47·5	50·0	36·0	34·0	30·5

All figures are stated in percentages of the legend displacement and all vessels are of recent construction. In advancing from the Queen Elizabeth of 25 knots to the Hood of 31 knots, the proportion of the displacement allotted to machinery is actually 1½ per cent. lower. That has been possible only by the adoption of small tube boilers, and the gain due to the introduction of these into the large type vessel will be more fully appreciated when it is pointed out that the increase of 92 per cent. in shaft horse power was obtained in the Hood with an increase in weight of only 32·5 per cent. as compared with the Queen Elizabeth. The net result of the change was a clear gain of 8 per cent. of the displacement which was wholly credited to armour and protection. The main armament of the Hood was identical with the Queen Elizabeth; hence with the larger displacement of the former the ratio dropped 4 per cent., which just covered the increased proportion of the weight allotted to the hull. It was therefore possible to produce a ship with all the characteristics of the battle-cruiser and yet provide sufficient armour and protection to place her in the battleship class. The writer pointed out in 1914 * that this method of analysis furnished a reasonable basis for estimating the qualities of a design. It may be immediately observed that the proportion of the displacement of any capital ship which can be allocated to the tactical, offensive, and defensive factors is generally in the neighbourhood of 60 per cent.

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* "Some Questions on Battleship Design," Institution of Naval Architects.

ARMAMENT IN FUTURE DESIGN.

Now, consider first the question of armament for any new design. In view of the practical constancy of the secondary armament, variation in armament weights is usually the effect of changes in the calibre of the primary guns. The complete weights of battleship armament have, therefore, been tabulated under that heading, the primary guns being in each case twin mounted and arranged in four barbettes on the centre line in accordance with current practice. It is, of course, obvious that a reduction in length of gun, number of rounds of ammunition or in secondary armament would operate to reduce the tabulated percentages and thus render possible the provision of higher speed, or increased protection. Generally speaking, that portion of the table between the two heavy lines indicates the possibilities for a given displacement.

TABLE SHOWING VARIATION IN BATTLESHIP ARMAMENT.

General diameter and length of bore.	Total weight of armament for ships.	Weights of armament in terms of percentage of displacement.							
		tons 20,000.	tons 25,000.	tons 30,000.	tons 35,000.	tons 40,000.	tons 45,000.	tons 50,000.	tons 55,000.
12″ 45-cal.	3000	15	12	10·0	8·6	7·5	6·6	6·0	5·4
12″ 50 ,,	3250	16·25	13	10·8	9·3	8·1	7·2	6·5	5·9
13·5″ 45 ,,	3500	17·5	14	11·57	10·0	8·75	7·8	7·0	6·3
15″ 45 ,,	5300	26·5	21·2	17·67	15·1	13·25	11·8	10·6	9·6
16″ 45 ,,	7100	35·5	28·4	23·66	20·3	17·75	15·8	14·2	12·9
16½″ 48 ,,	7600	38·0	30·4	25·3	21·7	19·0	16·9	15·2	13·8
18″ 45 ,,	8900	44·50	35·6	29·7	25·4	22·2	19·8	17·8	16·2

The ballistics of the more recent guns in the above table are added in the table given below, so that the advantage of passing to larger guns may be noted. The effect of passing to extreme arma-

BALLISTICS OF MORE RECENT GUNS.

Gun diameter and length of bore.	Weight of projectile.	Weight of bursting charge common shell. (H.E.).	Muzzle velocity.	Muzzle energy.	Penetration of W.I. at muzzle. Gavre formula. Uncapped projectile.
	lb.	lb.	f.s.	f.t.	ins.
15″ 42-cal.	1920	240	2450	79,910	54·7
16″ 45 ,,	2330	290	2500	100,980	60·4
	2100	230	2650	102,260	60·9
16½″ 45 ,,	2550	330	2500	110,510	62·3
	2300	260	2650	112,000	62·9
16½″ 48½ ,,	2550	330	2550	114,975	64·1
	2300	260	2700	116,265	64·6
18″ 45 ,,	3300	430	2400	131,800	64·4
	2970	335	2550	133,915	65·1

ments may be exemplified by considering the possible distribution of the weights of the U.S. battle-cruiser Lexington designed to be the fastest as well as the most heavily armed warship afloat. The figures are estimates based on the published particulars.

Equipment	3·0 per cent.
Armament	21·0 ,, ,,
Machinery	18·5 ,, ,,
Fuel (legend)	3·5 ,, ,,
Armour and protection	16·0 ,, ,,
Hull	38·0 ,, ,,
	100·0

It is thus seen that this vessel with the limited ratio of displacement which can be allotted to protective purposes probably holds also the record for the most lightly protected vessel of its kind afloat.

Percentage of Displacement for Various S.H.P.'s.

S.H.P.	Weight.	Displacement in tons.							
		20,000.	25,000.	30,000.	35,000.	40,000.	45,000.	50,000.	55,000.
25,000	990	4·95	3·96	3·3	—	—	—	—	—
50,000	2000	10·0	8·0	6·7	5·7	5·0	4·4	4·0	—
75,000	2700	13·5	10·8	9·0	7·7	6·75	6·0	5·4	—
100,000	3400	17·0	13·6	11·3	9·7	8·50	7·5	6·8	—
125,000	4200	21·0	16·8	14·0	12·0	10·6	9·3	8·4	7·6
150,000	5300	26·5	21·2	17·6	15·0	13·25	11·8	10·6	9·6
175,000	6200	31·0	24·8	20·6	17·7	15·5	13·8	12·4	11·2
200,000	7100	35·5	28·4	23·6	20·3	17·8	15·77	14·2	12·9

The table given above shows the percentage of displacement required for S.H.P.s from 25,000 to 200,000. The figures in column 2 are based on small tube boilers, oil fired as in H.M.S Hood, and, therefore, represent the maximum efficiency which can at present be obtained in terms of weight per S.H.P. The table does not extend beyond 200,000 S.H.P. as it is not desirable to put more than 50,000 S.H.P. through a single shaft, and five shafts or more are, at the moment, viewed with disfavour.

The last two tables for armament and machinery cover the whole possibilities of practice in the immediate future, and with their aid we may assume the present extreme limits of capital ship construction.

Naval authorities now appear to favour the high-speed vessel with adequate armour and protection, and the tendency is to merge the battleship and battle-cruiser into a single type. In view of the very heavy cost of these ships it is not likely that that policy will be departed from in the near future.

Possible Improvements in Battleship Design.

Jutland and other naval actions of the war have shown us, if they show us anything, that capital ships were capable of improvement in the following features amongst others :—

(1) They were one and all deficient in under-water protection.
(2) Their internal sub-division was not carried out to the fullest extent possible.
(3) The armoured side protection was too weak.
(4) The deck protection was entirely inadequate.
(5) The stowage of ammunition could have been improved.
(6) No adequate provision existed for righting heel or trim.
(7) The auxiliary armament was insufficiently protected.
(8) The night sighting was bad.
(9) The search lights were inferior to those of the enemy.
(10) The range finding was capable of improvement.

Respecting attacks from the air, if the decks and auxiliary armament receive the consideration they demand for reasonable protection against gunfire during the battle, then, practically all further defence must be left to the Air Squadrons which will always act in conjunction with the fleet of the future.

It is, of course, absurd to suggest the possibility of constructing a capital ship capable of withstanding any offensive effort that might be opposed to it, but speaking from a long practical experience and taking into account the capital vessels of the present day, the lessons of the war, and the possibility of present-day construction and enterprise, the writer is convinced that it is possible to produce a capital ship that would withstand, without foundering, a torpedo attack, that would at ordinary fighting range remain in action though heavily punished with gunfire, that would have her main and auxiliary armament and her directing officers and staff adequately protected, and that would have a chance to live through any action however severe.

This brings us to the question of the warship of the future. Without doubt the aim of the Naval Authorities will be the production of a ship with the maximum gun power available and the highest possible speed, consistent with the provision of armour and protection equivalent in weight to at least from 30 to 34 per cent. of the legend displacement. Financial considerations alone will restrict their achievements in that direction. We have, therefore, only to estimate the maximum possibilities in the present position of Engineering Science in order to arrive approximately at the type of capital ship which is the ultimate aim of the principal Naval Powers. The figures of the last two tables furnish the information necessary to make that approximation.

Taking 32 per cent. of displacement as allotted to armour and protection, we have 28 per cent. remaining for armament and power. Extending the tables slightly beyond the given figures, we obtain at 57,000 tons displacement 15·6 per cent. for armament and 12·4 per cent. for maximum engine power, the total of which gives the required figure. The approximate dimensions, etc., of such a ship would then be—

Length between perpendiculars	932′ 0″
Breadth, extreme.	112′ 0″
Draught	31′ 6″
Displacement at legend draught . . .	57,000
Shaft horse power	200,000
Speed at load draught, about	33½ knots
Main armament	8 18-in. 45-cal. guns

Beyond that displacement, with constant shaft horse power and armament, the protection ratio will steadily increase, but the tactical factor—speed—will begin to diminish; hence without further advance, in machinery or guns, it is scarcely likely that that figure will be exceeded. The cost of such a ship will be prohibitive to all but the most powerful nations, and, even for these, the battle-fleet will be restricted to a much reduced number of such units.

The writer is convinced that the capital ship, things being what they are, must of necessity continue to grow in size, and by its very growth add to its might and to its invulnerability, but that it will over-reach the limit outlined is unlikely. It may be that, before it has reached such limit, science with its magic wand, or the inventive genius of man, will so change the existing circumstances of material performance as to make it possible to carry out on smaller weights and dimensions the purposes and objects for which capital ships live and move and have their being.

GEORGE THURSTON.

CHAPTER V.

THE INFLUENCE ON ORDNANCE OF RECENT WAR EXPERIENCE.

PREVIOUS to 1914 it was not at all uncommon in comparing the British Fleet with other powerful fleets such as those of Germany or America, to limit oneself to enumerating the respective totals in the matter of dreadnoughts. In fact, this was the generally accepted standard of comparison, and it was quite the usual thing to picture the Fleet as consisting of huge ships armed with guns of great power and extraordinary range and protected by armour which was considered to be almost impenetrable. It was, of course, not overlooked that cruisers, destroyers, and submarines form part of the Fleet, but in a more or less minor capacity, the naval strength of a Fleet being measured by its number of capital ships and the weight of metal which could be projected per minute. The experiences of the War, however, considerably modified such views, and far more was heard of the destructive power of the submarine than of the battleship, and in many quarters the view was held that the submarine was the ship of the future.

There is, however, no intention of dealing in this chapter with the relative values of the various types of ships ranging from the dreadnought to the submarine. It is assumed as a principle that paramount sea-power can only exist on a basis of overwhelming battleship strength, and that such ships as the largest size battleships and heavily armed cruisers should be considered as very mobile gun platforms. It is, therefore, at this point quite pertinent to consider the influence of war experience on the gun and its mounting.

It is too early yet, even if it were discreet, to write with any confidence or authority concerning the calibre and ballistic properties of the main armament of future battleships. The experience of the War has demonstrated beyond doubt that victory lies with the large calibre gun, if correctly handled so as to ensure rapidity of fire and accuracy. Long range and smashing power are assured to it, and it is worse than futile to oppose a ship having inferior striking power to one which has superiority in weight of ordnance and protective armour. All things being equal, therefore, the whole tendency must be to larger guns.

THE BIG GUN.

For a long period—long in point of time as to modern ordnance—the 12-in. gun held sway, and was considered for all practical purposes to be the limit for naval work. Whether it was a question of tradition which slowed up enterprise throughout the maritime nations of the world, or one of economy, the fact remains that it was with much hesitation and reluctance that the 13·5-in. and then the 15-in. guns were introduced. Now that a move has been made in the direction of heavier guns, we may expect to see before long even larger guns in use in all navies. In point of size there is really no mechanical limit to man's ingenuity. Though a great increase over the above sizes would now tax the resources of the ordnance manufacturer, yet it is but a simple process of development to enlarge the manufacturing plant to cope with the increased dimensions.

The experience of the War has also shown the necessity for stronger gun-houses, for thicker roof plates to turrets, thicker walls and greater protection generally to the ship, also for long-range firing, requiring increased elevation of guns; for accuracy in range-finding and spotting, and for more exact methods of sighting the guns; mere rapidity in rate of fire is of secondary value as compared with accuracy both of laying and of range. In the Director Firing system, so successfully developed and enlarged, we have an agency of peculiar power for accurate laying—providing in the first place the possibility of clear vision from the sighting position on the mast, and then the simultaneous discharge of an accurately laid broadside of tremendous hitting power. With range-finding the tendency is for larger and yet larger instruments. The length now reached in the modern instrument is a 30-ft. base, but even this is necessary at the extreme ranges, and the many disturbing influences to be contended with leaves much to be desired. Moreover, any large instruments of this kind cannot well be supported on the mast at a height at which clear vision and an extended horizon can be secured. There is a possibility of a limit being reached in this class of instrument, pointing to the need for the adoption of some new method of working, not necessarily visual.

With the tendency to increase the gun-elevation so as to obtain longer ranges, there arises a remote condition of hitting at the extreme range of the modern large gun, because it brings into existence the possibility of getting beyond the scope of the range-finder. Not only so, but when it is considered that the target presented by the enemy ship, at 15 or 20 miles, distance, must obviously be extremely small, it can be readily realised that a limit can be set to the range at which firing is of any practical value, and the elevation of the gun should correspondingly cease.

SECONDARY ARMAMENT.

The effect of the angle of fire on length of range, and the influence of high explosives and bursting charges were considered in a previous issue of the "Naval Annual." The subject of up-to-date breech mechanisms and improvements in gun-mounting and sighting-gear, and the influence of these on rapidity and accuracy of fire were also dealt with. We will now, therefore, specially direct attention to the nature and mounting of the secondary armament, which is equally important to that of the main armament in modern naval warfare, and in speaking of the secondary armament it should be understood that the term includes weapons suitable for light cruisers, destroyers, and submarines. Naturally, great changes were effected during the War with respect to secondary armament, and how these will probably affect the future development of this class of war material is deserving of the most serious consideration.

The day of the smaller calibres, such as 3-pdr., 6-pdr., and 12-pdr., and the like, would appear to be past, and in their place there have come the 4-in., 4·7-in., and 6-in. guns up to 50 calibres. The increasing range of effectiveness of the modern torpedo, together with its accuracy and regularity of action, is one of the most important factors in determining the increase of size of guns for the secondary armament.

Of recent years, dating back even as far as the battle of Tsushima, the necessity for increased elevations has become increasingly important. In the reports of this great naval engagement, some of the ships, particularly those of the Russian Navy, which had been badly hit by the Japanese, became heavily listed, with the consequence that the elevation of the guns was completely neutralised, and they were therefore practically out of action except for point-blank firing.

For all modern guns the increased angle of elevation is likely, in the future, to be adopted, and such elevations should not be less than 30°. Indeed, it seems most likely that in future the elevation will be not less than about 35° to 40°, it being well known that the maximum range of any gun, with ballistics at present in general use, is obtained at from 38° to 42° elevation. Moreover, for certain purposes, the increased angle of descent obtained at the higher angles of elevation is necessary to utilise the advantage of the most destructive effect of the projectile, notably when firing at submarines under some conditions, attempting to produce destructive effect on the deck of a vessel, or attacking shore batteries.

The increased angle of elevation has completely revolutionised the construction of the gun mounting, the old-fashioned centre pivot mounting being now practically obsolete. There would seem to be little doubt that the best method of defence of ships against aircraft is the use of efficient anti-aircraft guns, with, of course, the most effective means of height and range-finding, etc.

AIRCRAFT GUNS.

It is highly probable that in the next war the use of aircraft will be very much more extensive than has hitherto been the case. In a naval engagement, means are available for concentrating the fire upon any particular ship of the enemy fleet, and something of the sort may have to be developed for concentration of fire against any particular enemy aircraft. The size of gun best suited for anti-aircraft purposes is still a matter of speculation, and will be largely governed by the altitude from which observation and consequently accurate bombing can be carried out, but the days of the lighter guns, which were originally employed for this purpose, seem to be numbered; in other words, destructive power and long range are likely to be the ruling factors in the future, just as is the case, already referred to, with secondary armaments for repelling submarines and torpedo attack. Of course, the number of guns composing the secondary armament is limited. It therefore forms an important consideration as to whether or not it is possible to mount the guns of the secondary armament in such a way that they may serve the ordinary fighting purposes for vessels afloat as well as against aircraft.

The arrangement of sighting gear for anti-aircraft purposes is much more complicated than that required for ordinary purposes, and the construction of a sight to serve the double purpose is, to some extent, further complicated. Naturally, the height from the deck to the centre of the gun, in the case of anti-aircraft weapons, is greater than that required for ordinary fighting purposes, and to embody both the kind of sight required and the requisite height for firing up to, say 85°, is very undesirable from some points of view, in the case of the gun for ordinary service, and the matter does not yet seem to be finally determined as to whether it is better to make all the secondary armament suitable for the double service, or a portion only of it, or to keep the two services separate. It may be, however, that the solution will be found in making a certain number of the guns for the ordinary service only, and designing the remainder specially as anti-aircraft guns, but with the possibility of using them for ordinary service in an emergency.

Another matter of some importance is that whereas in the case of the ordinary service, any gun up to 6-in. calibre may be served by hand, for anti-aircraft purposes this is not possible at the high angles of elevation, mechanical means being required for loading the projectile.

THE PROBLEM OF CASEMATES IN CAPITAL SHIPS.

In all the above remarks referring to the secondary armament, we have been considering only those guns which, in the case of a battleship, are mounted on the upper deck. There remains, however, still to be considered, the question as to whether or not the use of the casemate will still be continued for battleships and battle-cruisers for the secondary armament; its position, when this method of mounting the guns is adopted, means that the gun is so close to the water-level that the gun-layer's situation is one not only of great discomfort in a heavy sea, but one where it becomes almost impossible to sight properly, owing to spray, smoke from other guns, low visibility, etc. The height between the decks, where casemates are employed, needs to be greatly increased in order to obtain the higher elevation. This in turn needs a greater depth of armour plate. It would seem, therefore, most probable that in future battleships' and battle-cruisers' secondary guns will be placed much higher above the water-line.

SUBMARINE GUNS.

The mounting of guns in submarines, like the mounting of ordnance for most other purposes, commenced with comparatively small beginnings, and comparatively little had been done in this direction previous to 1914. In the earlier stages of the gun mountings for this purpose, precautions were adopted for protection against the destructive effect of the salt water on the working parts. This was, however, very soon found to be not only difficult to accomplish, but subsequently proved to be quite unnecessary when suitable materials were employed and the necessary care taken for their preservation by those in charge. On these mountings all parts not subjected to the shock of gun-fire were made of gunmetal or bronze, and it was found that not only did these materials withstand the ravages of the sea, but in all cases, after constant usage and long exposure, the whole mechanism was found to be in a high state of efficiency. Considerable attention was, of course, given to these mountings by the gun crew.

Hydro-Pneumatic Running-out Gear.

For a long period it has been the almost unvarying practice, particularly on secondary armament, to have the power for "running the gun out to battery" after firing, supplied by springs. The modern tendency is to adopt the hydro-pneumatic system in consequence of the regularity of action and the complete control which may be obtained over the same. This is particularly noticeable in the case of mountings for guns for anti-aircraft purposes, and this point will be readily appreciated when it is remembered that the gun has to be under perfect control when running out either horizontally or vertically. The great power required to run the gun out when vertical is, of course, not required when running it out in the horizontal position, and this power must be controlled in such a way that the gun is brought gently to rest, even when running out in the horizontal position.

Armament for Small Craft.

With regard to the armament for light cruisers and destroyers, at the outbreak of war most light cruisers mounted a combination of 6-in. and 4-in. guns, and the destroyers were fitted, some with 3-in. guns and some with 4-in. guns. As naval warfare developed it was found advisable to increase the armament on all the light cruisers, to dispense with the 4-in. gun, and adopt one of larger calibre. Owing to the very serious menace of the German submarines, which were fitted with 5·9-in. guns, it was deemed advisable in the latest types of destroyers to increase the armament to a size exceeding 3 in. and 4 in. There is no doubt that the advance to larger calibres in anti-torpedo armament is almost entirely due to the development of the submarine, the destroyer, and to the torpedo, with its increased effective range. It seems to be fairly well established that heavier armament is necessary effectively to oppose a destroyer of the latest type, and guns even approaching 6-in. calibre may be employed.

Anti-aircraft guns have played a most important part, not only in land service defences, but also in the case of naval service, and it will be fully appreciated that the problem of air attack, and particularly of defence, is even yet practically only in its early stages of development, and it is undesirable to publish any particulars of the lines on which this subject is being developed.

Much more might be written on the influence of war experience on Ordnance; only salient features have been dealt with, but it can be said truly that the ordnance firms did great service to the nation. If to-day their great ability in research, ingenuity in design and accuracy in manufacture are turned to productions of peace, there is consolation in the thought that their qualities, essential for national defence, are only dormant, and the experience is safely locked away to become useful if ever the world's peace should be challenged.

CHAPTER VI.

NAVAL ENGINEERING RESEARCH AND EXPERIMENTAL WORK.

IT is generally recognised that the time for experimental research in any industrial undertaking is during periods of decreased production. Then all concerned have more time for that leisurely thinking essential for the formulation of problems to be solved, while those intimately responsible for the research can concentrate upon the work of experiment without being interrupted by the difficulties which arise in the course of production in the workshops. Such continuity of thought is essential to success. If this be true of industrial undertakings, how much more is it accurate as regards the Navy? Those responsible for the *matériel* as well as the *personnel* of our fighting forces have passed through strenuous years, and in earlier issues of the "Naval Annual" much information has been given regarding their activities and the developments suggested by war experience. It is accepted that for the present the programme of new construction must be on an absolutely minimum basis. The time is therefore opportune for a survey of the situation so far as design is concerned. Such a view may be observational, but ought, to a much greater extent, to be experimental.

Prior to the war, little had been done directly by the Admiralty in experimental engineering research. There was established many years ago a ship model experimental tank at Torquay by the late Dr. William Froude, whose work was carried on by his son, Dr. R. E. Froude, at the Government Tank at Haslar, and most satisfactory work has been achieved in the improvement of the lines of ships and of the form and dimensions of propellers and in other directions. There have been for many years past gunnery and torpedo experimental stations at Portsmouth. There was also established at Haslar an oil fuel experimental department, where excellent work was done in devising means for efficiently burning oil fuel, first in destroyers, and subsequently in all types of warships. These were the only experimental establishments under the direct control of the Admiralty. At first sight this may seem surprising, but it is explained by the fact that large, if not ample, facilities existed elsewhere for obtaining information, and for carrying out the necessary preliminary investigation and research, and the subsequent experiments. For many years the Admiralty relied upon the following sources of information for the development and improvement of machinery: (*a*) The work of private manufacturing firms, institutions, individuals, steamship companies, etc.; (*b*) experimental work and general experience in the Royal Navy;

(*c*) experiments in the Royal Dockyards and other Government establishments; and (*d*) experiments carried out by private firms or individuals at the cost of the Admiralty.

With such an extensive field on which to draw a vast fund of information was always available, from which development, both in type and detail, could, and did, proceeed at a rapid rate, and the progress was such that, in all types of warships, British naval steam machinery, when compared with that of other countries, was in a leading position in design, in power, and in performance. This is saying a great deal, in view of the strenuous and praiseworthy efforts made by our competitors to overhaul us, but it is not saying too much. Good as these efforts were, it is thought that they were always behind in the race. That being the case, it might quite properly be contended that we should continue as heretofore. But continuation is only possible if the conditions and circumstances remain the same.

For many years before the war there was always a considerable building programme and commercial considerations fostered private enterprise, because it was anticipated that the successful results of experimental work, even if expensive, would find its reward in the adoption of the results and in the consequent share of the numerous warship orders. It would be easy to give many examples where extensive and costly experimental work was carried out by private firms, with great advantage not only to the Navy but to science generally and to marine propulsion in particular. There was the work of Sir Charles Parsons on the turbine, gearing, and superheated steam; of Messrs. John Brown & Co. in a long series of tests on the application of the turbine to the Carmania, and, later, their research on impulse turbines, blading, and the tendency of the rotor to whip; of Messrs. Vickers, in relation to the internal-combustion engine and machinery generally for submarine craft. Other examples, effective in their influence on the Navy, although not of such long duration or so expensive, will occur to the reader conversant with modern developments. The conditions, however, have now changed. With the reduction in warship building, it cannot be expected that experimental work for naval purposes will be so readily undertaken by private enterprise, in the absence of a definite prospect of early recompense in the form of orders for new construction. Moreover, there are problems in connection with merchant ship propulsion equally attractive and equally important, and offering immediate reward in contracts for economical cargo carriers, intermediate liners, and ocean mail steamers.

THE INFLUENCE OF NAVAL EXPERIMENTS UPON MERCHANT WORK.

Experimental work and experience in warships have been extremely valuable in the development of improvements in details, and in indicating the desirability of changes in type and design. Indeed, naval practice thus guided has led or encouraged merchant shipbuilding in several directions. The long research carried out in private works in connection with water-tube boilers, combined with experience afloat, has led to the high standard of manufacture required to ensure the success of this type, and to-day the result of this research is of great advantage in boiler work for general purposes, apart from its influence on the application of water-tube boilers to merchant ships. The merchant service, too, is now following the example of the Admiralty in the adoption of oil fuel instead of coal, due in part to the high price of coal and in part to reduction of labour in the stokehold, which, at the present rates of wages, is a heavy charge on the merchant ship. Numerous fittings, such as burners, heaters, filters, and brickwork, entirely developed in and for the naval service, have been of considerable value to shipowners and shipbuilders. Naval practice in respect to specification, storing, handling, and burning of oil fuel has also been of great advantage. The application of the impulse design of turbine for marine work, now widely adopted in the merchant service, followed naval initiation. There was reciprocal service done by the merchant marine in connection with geared turbines, for, while this system was first tried in the merchant service, the development of the geared turbine was greatly hastened by the demands of the naval service, resulting in many improvements in blading, materials, and fixtures, originally applied in naval ships and now adopted in the merchant marine. The bulk of the early experience with reduction gear was obtained in the naval service, where it was used primarily for cruising turbines. This led to improvements, both in materials and design, now adopted in all ships. The large demands for naval work also stimulated the manufacture of gear-cutting machines and gear-cutting practice, which has led to this industry being in a position to meet mercantile demands. The adoption and application on a large scale of the Michell thrust block (fully described in previous issues of the "Naval Annual") and the intensive experience gained in naval service has led to the greatly increased use of this principle on all types of ships. The first design for journals in use was adopted in a large naval installation, and affords valuable experience for very far-reaching applications of the principle, alike in the Royal Navy and the merchant marine.

Automatic feed regulators and valves, forced lubrication, evaporators, full-bore safety valves, flexible seated valves, closed feed circuits, etc., may be quoted as further developments of Admiralty requirements which have been adopted in the merchant service. The necessity of extreme lightness led, in naval design, to light scantlings and special facilities for the manufacture of high-grade material. Boiler tubes and steam-pipes are solid drawn, and the manufacturing facilities developed for this purpose have led to increasing use in both naval and merchant vessels. Copper piping, turbine blading, condenser tubes, propeller bronzes, cast steel, and many other specialities have received a considerable impetus from naval demands, with advantage for general commerce and mercantile use. Very rapid developments in the power and lightness of internal-combustion engines have occurred of late years in connection with light naval craft, which have had a marked influence on commercial work.

Economy in steam consumption has always been an important factor in the design of naval machinery—at full power because a corresponding reduction in the evaporative capacity, and therefore in the size of boilers, is effected, and at lower powers because of the saving in fuel expenditure that results.

These two considerations are, in several respects, antagonistic, and the full benefit cannot be realised in the conditions of Naval Service, but the experience obtained in the evolution of naval designs can be—and has been—applied with a greater measure of advantage in the Merchant Service, and the saving in fuel costs resulting therefrom must be very considerable.

But applications and developments in warships must, of necessity, always be of a limited character. Nothing can be put into the machinery of warships which cannot be fully relied upon to stand up to its duty in the time of stress. In order to ensure this, innovations are not introduced without searching inquiry as to their satisfactory performance elsewhere. For the same reason warships cannot be used for research and preliminary experiment. The dockyards and shore establishments can only be used for continuing trials which have advanced beyond the preliminary stages. Valuable contributions to progress have been made by utilising the everyday work of the dockyards, but here again there are limits, as the dockyards exist for building and engining new ships and for repairs to existing vessels. Investigations can only be carried out provided the normal productive work of the establishments is not interfered with. This applies equally to private factories; the experimental department must proceed independently of manufacture; it must be in advance, not in parallel.

OFFICIAL VERSUS UNOFFICIAL EXPERIMENTING.

Experiments carried out by private firms or individuals at the cost of the Admiralty have been open to the objection that the particular persons selected for such work receive experience at the expense of the State; this may be regarded by their competitors as an unfair advantage. The information supplied to the Admiralty as the result of independent research, investigation, experiment, and experience, from universities, technical institutions, steamship companies, and other private undertakings, has been very valuable, and for this help much gratitude is felt. It is considered, too, that similar assistance will always be available for the benefit of the Navy, but as such work has generally been undertaken primarily for other reasons, it is frequently found that the application for purely naval purposes has not been sufficiently provided for and that further investigation is necessary.

These briefly stated are the conditions that must be kept in view in formulating a scheme for experimental work for the Navy of equal, if not of greater, efficiency than that existing prior to the war. As circumstances have changed, in view of the great reduction in warship building, it is impossible to expect private assistance to be given except to a very limited extent. With the restrictions that always exist in the utilisation of other sources, it follows that the Admiralty must in future provide itself with facilities for any research and preliminary experiment required; in other words, an Admiralty Engineering Laboratory is necessary for such purposes. This necessity has been proved in other departments of the Admiralty. Ship model tanks, and gunnery and torpedo experimental stations, as already stated, have been established for many years for work which is essentially and entirely of a naval character. The German and Austrian Admiralties, without the same wide field of resource that we had, provided themselves with engineering experimental stations, and some years ago a naval engineering laboratory was established in the United States of America.

Even with the facilities which this country possessed, occasions frequently occurred in which, sometimes on account of their confidential nature, at other times on account of their character, research could not be efficiently carried through except by naval experts, and on these occasions the want of an engineering laboratory was very seriously felt. This was realised on more than one occasion during the war by the Board of Invention and Research, and that organisation, through its engineering committees, composed of eminent naval architects and marine engineers accustomed to naval requirements, strongly urged the establishment of a naval engineering laboratory.

THE FIRST ADMIRALTY ENGINEERING LABORATORY.

The representations made by these influential committees were successful, and in January, 1917, by the courtesy of the authorities of the Imperial College of Science and Technology and of the City and Guilds Engineering College, and, with the valuable assistance of Professor W. E. Dalby, the Admiralty Engineering Laboratory was founded under the directorship of Sir Dugald Clerk. The problem first tackled by the Laboratory, viz. that of obtaining higher power per cylinder from fast-running Diesel engines, is typical of those which emphasise the necessity for a Laboratory for purely naval work. The marine Diesel engines constructed in this country were made almost entirely under licences from firms in foreign countries, and it seems fair to assume that in this country Diesel engine builders were, generally speaking, manufacturers rather than designers. Very much the same state of affairs exists to-day. In itself it is not satisfactory that for machinery designs for war vessels we should be dependent upon foreigners. Fortunately for us, we had one firm who were able to meet requirements in this respect, and their productions served us, and served us well, right through the war.

This state of affairs can be easily explained. There is no disparagement of British engineering in this statement of the case. Continental countries, with a limited supply of coal of good steam quality, were naturally forced to develop the gas and oil engine as substitutes for the steam engine. Considerable ingenuity was concentrated by them in this direction, and experience in working the internal-combustion prime movers led to greater success, and thus in this direction the Continental engineers excelled our engineers. In Britain, on the other hand, there was an abundant supply of cheap coal, and our engineers devoted themselves to the improvement of the steam engine and, later, to the evolution and perfection of the steam turbine, and thus we became pioneers and predominant as a steam engineering nation. Now, with coal at its present price, and little hope of an appreciable reduction, there is need for experimental work on this engine, not only for the Navy but for the merchant service. Indeed it is a very important national duty for the Admiralty to take up this work, because the most unsatisfactory feature of building under foreign licences is that if we follow the lead of Continental engineers we are always behind them, and in following in docile manner the instructions given, as is inevitable under a licence, there is danger that we lose the power of initiative, which has always been a considerable advantage. It is often a condition of a licence that improvements made by licensees become the mutual property of themselves and the licensor. Combination of effort is thus tempered, if it does not become practically stultified, and although normally competition stimulates improvement, it is not always the case that such improvement is along the line desired. In the peculiar manner in which the Diesel engine has developed, competition has rarely produced improvements in the form really suitable for naval purposes.

The Work done at the Laboratory.

It was felt, however, that a great many of the improvements could be adapted for naval needs in the Laboratory, and efforts were directed accordingly. An important measure of success was soon realised in the Admiralty Laboratory, first founded in January, 1917, by the adoption of pistons of aluminium alloy. This enabled the revolutions of the standard submarine engine to be increased, resulting in a greater power on a reduced weight. After satisfactory trial afloat, this metal has been utilised with practical advantage in a considerable number of submarine propelling engines.

In the later stages of the war it was felt to be something of a professional reproach that our submarine engines were only capable of developing 100 B.H.P. per cylinder. This was afterwards increased to 120 B.H.P. by the modification referred to above and to 160 B.H.P. in the Laboratory, but this latter result came too late to be utilised afloat during the war. The cylinders of the German submarine engines developed 300 B.H.P. per cylinder, and even more. Apart altogether from the greater experience of the German engineers, for reasons already given, it is only fair to say that there was no practical call for this increased power in British submarines until the higher power of the German engines became known. The call could have been met earlier had its need arisen, as facilities existed for giving such higher power in another manner, although then the capacity for production of the improved type in this country would have been limited.

The standard engine had also been preferred, in the British service, to all new types because it was familiar to the *personnel* of the submarine service, because of its proved reliability, and because of the facilities which were provided and utilised for its rapid production throughout the war. Furthermore, the German engine, although it permitted of considerable and useful saving of floor space, showed no superiority over our engines in weight. But, when the desire was expressed for a cylinder of high power, the problem was set to the Laboratory and solved in a very short time. An experimental unit was designed by the Laboratory and made to this design by the engineering department of Chatham Dockyard. It has been used extensively and under severe trial conditions, and has given results superior to the best obtained from the German engine.* It has yet to be tried afloat, but the results are such that very little doubt exists as to its satisfactory performance when so tried. These are examples of the work that can be carried out in an Admiralty Engineering Laboratory, and they go to confirm the contention that experimental work which is essentially of a naval type can be carried out much more satisfactorily under naval superintendence, with full knowledge of the purpose and of details of requirements, in an establishment specially equipped for the purpose. It is probable that results for this particular class of work could not be arrived at so quickly elsewhere.

THE NEW ADMIRALTY LABORATORY AT WEST DRAYTON.

Admiralty officers will always remember with gratitude the facilities given by the authorities of the Imperial College, and the cordial and most useful assistance given by the various members of the College staffs. It was known, however, that the Laboratory could not be permanently housed at the Imperial College, and with the resumption of normal training work at the College a new site for the Laboratory had to be found.

The Laboratory has been transferred to West Drayton, near Uxbridge, where buildings existed which had previously been used for other Government experimental work and which proved to be suitable for laboratory purposes with very little alteration. The work of transfer is complete and experimental work has been recommenced. This work will, for the immediate future, take the form of developing the high-powered, fast-running Diesel engine for purely naval purposes, and this will include testing the relative merits of four-cycle and two-cycle engines for these purposes, and ascertaining the adaptability of the double-acting principle for naval needs. These are the lines on which many engineers in all countries have been working, but so far without definite result. There is involved in the solution a large number of incidental and accessory problems.

It will be the duty of the Laboratory to keep in touch with experimental and research work that may be going on elsewhere in connection with Diesel engines for commercial purposes, utilising the results gained in the Laboratory, if advantageous to do so. This will avoid overlapping. In return, the Admiralty, no doubt, would supply, as far as Service conditions would permit, information obtained in their laboratory which might be useful to others working to the same end, and giving information of their results. This reciprocation is to be highly commended.

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* See "Engineering," vol. cx. pp. 101 and 127.

METALLURGY.

A noteworthy feature in the organisation of the Laboratory is the inclusion of a Metallurgical Section. It is now generally recognised that a knowledge of the structure and constitution of the commonly used metals and their principal alloys, and the effect of heat treatment upon their physical and mechanical properties and their durability, must take an important place in the development of engineering research and experiment. Proof of this is found in the valuable assistance which has been given by the Metallurgical Section of the Admiralty Chemists' Department, Portsmouth, in the solution of engineering problems in the past, in advice of the same nature which has been given by private metallurgists, and in the fact that important foundries and many other engineering establishments permanently employ metallurgists of standing, many of whom take a large share in the technical control of the operations in the works affecting the quality of materials. Modern metallurgy has not yet fully taken the part that it must take in dealing with engineering problems, and this is probably due to lack of training on both sides and to want of the necessary co-ordination. The Admiralty is recognising the necessity for utilising this science in its engineering service by giving all engineer officers now under training a fairly comprehensive course of instruction in metallurgical principles, and it is felt that this will be ultimately of considerable value to the service. With the same underlying idea a Metallurgical Section has been established in the Laboratory, and it is believed that the close connection of the engineer and the metallurgist working side by side in the same building, each seeing the work of the other and their combined results, will do a great deal towards effecting the co-ordination and combination of their work that is desired. Particularly will this be the case in the experimental work on the Diesel engine.

PROBLEMS FOR RESEARCH AND EXPERIMENT.

Repeated reference has been made in this article to the fact that the Admiralty Engineering Laboratory should only be used for purely naval problems, and very little reflection will be necessary for the acceptance of this view. It could not be otherwise. The field of research and experiment for naval engineering generally is so great that it could not be all undertaken in a single establishment of reasonable dimensions. For such work as is of common interest, developments must be looked for elsewhere, either through

Admiralty initiative, execution, and expense, or by the sole enterprise of others with or without the prospect of commercial gain.

As an instance of this class of problem may be mentioned that of the use of superheated steam. The difficulty in the Navy has been due to the fact that, while a high-powered installation is provided in a warship to attain full speed, 80 per cent. of the steaming of the ship is done at cruising speed, and this has hitherto required only one-eighth to one-tenth of the full power, or even less. The conditions of weight and space are such that, while it was a simple matter to arrange for a moderate degree of superheat at full power, it was difficult to obtain anything more than a small fraction at cruising powers. Experiments have recently been carried out for the Admiralty, the conditions being those of an essentially naval installation. The results are encouraging, and it is hoped in future to instal superheaters which will give a very useful degree of superheat at low power without any serious risk of overheating at the higher powers. It will be arranged hereafter for the Laboratory either to make such experiments as these or to control them departmentally, but they cannot be made at the Laboratory at present.

The very valuable research which is being carried out by the Corrosion Research Committee of the Institute of Metals on the corrosion of condenser tubes is of great interest to the Admiralty, and is another example of this class of experimental work.

Post-research experiment and experience in the Service afloat was used even during the war, and is being used now. It has previously been explained that great caution is exercised before essential fittings, and to a lesser degree even accessory fittings, are introduced in the machinery of the Fleet. Special machinery exists for bringing forward for consideration inventions and likely improvements, and this is so complete that it is improbable that much escapes notice, but the merits and disadvantages of such are highly criticised, opinions of users are sought and other means utilised to ensure that new apparatus or fittings are suitable for use in warship machinery before they are adapted even for trial. The object of trial in ships afloat is to ascertain by actual experience under Service conditions whether machinery or fittings are satisfactory for general adoption as they are supplied or whether modifications are necessary.

Although war time is not a suitable time for experiments of any kind, no matter how late in the stage of their development, it is noteworthy that the preliminary research work and test experiments afloat in connection with geared turbines and Michell thrust bearings, described in previous issues of the "Naval Annual," begun before the commencement of the war, developed so satisfactorily during the war that these were adopted for all classes of vessels. To have introduced radical changes such as these during a war indicates not only the confidence in the types on the part of those responsible for the changes, but the thoroughness of the preliminary and experimental work which enabled such definite and confident opinions to be formed.

Other work of this character which is being carried out by the Service afloat includes the following: (1) Improvements in air supply to boiler rooms. (2) Testing new types of auxiliary machinery which have been introduced for the purpose of obtaining greater economy, *e.g.* geared turbo-fan engines and fast-running reciprocating fan engines. (3) Improvements in the disposition of tubes in water-tube boilers, with the object of reducing tube heating surface and weight of boilers. (4) Electrolytic processes of protection. (5) The closed feed-circuit system. (6) Testing various types of condenser tubes.

A final example of the research in progress for the Navy is a very interesting investigation that is being made in the Chemical Laboratory at the Royal Naval College at Greenwich on the subject of boiler corrosion. Cases of very rapid deterioration of the tubes of water-tube boilers occurred during the war, although these boilers had received the prescribed treatment for the preservation of boilers of this type which generally results in a much longer life than was obtained in the cases referred to. The problem of boiler corrosion is an intricate one, and a high degree of forcing, especially when frequently maintained for considerable periods at short intervals, may bring about a set of conditions for which ordinary treatment does not provide. The Laboratory at Greenwich is endeavouring to reproduce these conditions on a smaller scale, and to ascertain the circumstances under which rapid deterioration occurs and to find a remedy. The result if successful and complete should be of great value.

The Value of Research and Experiment.

Having given a description of the methods and direction of Admiralty experimental work, this chapter may fittingly be concluded by an enforcement of the fact that research and experimental work are expensive, although justified where the results achieved have the effect of ensuring ultimately reduced costs or increased efficiency, as is nearly always the case. It is often said that even if we stop warship building we ought not to stop experimental work connected therewith, and probably in the minds of those who express this pious wish is the thought that not only will the expense of warship building be avoided but also that the experimental work will cost very little. That this is fallacious would readily be affirmed by those who are acquainted with the expenditure upon the research and experiments connected with the evolution of the turbine, gearing, and the water-tube boiler, and by those who are now incurring expense in the development of the commercial Diesel engine. It is to be recognised that research and experimental work necessarily involve expense, and very often the results obtained over long periods are not apparently commensurate with the expense. But if the experiments at the Admiralty Engineering Laboratory, and the associated experiments, receive sufficient practical encouragement, it is considered that, in spite of the reduction of the shipbuilding programme, the Service can keep itself in the forefront in knowledge of developments and readiness to apply them.

A broad view should be taken in connection with the financing of experimental work. Expenditure is unavoidable, and in measuring the results, in order to determine whether they are commensurate with the cost, consideration must be given to the value of the negative as well as the positive results. If by experiment possible failure in warships can be obviated, then great gain accrues. The surety that our ships will be able to meet the greatest stress of action must increase confidence in the Navy. It is to be remembered that our warships must cost an enormous sum in the future. The expenditure on experimental work will bear a small proportion to the total sum devoted to each ship. Research must prove economical as well as assuring. Thus whatever money is spent on research must yield a large dividend in the form of efficiency in *matériel*, and the consciousness that, whatever betide in the future, the public will realise that the best is put into our Navy.

G. G. GOODWIN.

CHAPTER VII.

APPLIED SCIENCE AND INVENTION IN THE NAVY DURING THE WAR.

WITH the relaxation of war-time restrictions, it has become possible to publish the results of certain researches which have been carried out during the war for the Government by some of our leading scientists. The need for secrecy having been removed, some particulars of much work which is of general interest can be made public. Though much must still be withheld, it will be clear to all that the war had an enormous effect in speeding up certain lines of research, directed toward immediate military applications. The war made it necessary that much energy and money should be expended on research, and the normal stride of scientific progress was lengthened under the spur of necessity during these years, with the result that, in some instances, the leisurely advance of science was enormously accelerated. It is true that some of these quickly gained results were won at great expense, and many failures were recorded owing to lack of the necessary fundamental knowledge. Again and again it was found that a new research depended on, or was the result of, previous work whose value had at the time possibly not been fully recognised, or whose applications had not been clear. In the war, pure research time and again proved its value as an investment, while in many instances work which was apparently devoid of practical value bore interest in the most unexpected fashion.

Much of the research which has been accomplished is not only valuable from the point of view of its military and war-time uses, but—as will be seen later in this chapter—devices which were designed and experimented with as purely fighting appliances, and which were developed under war conditions for use in war, can be adapted to peaceful purposes and have already in some instances shown themselves to be of great potential value in commerce—true instances of swords beaten into ploughshares. Arrangements are made by the Admiralty to inform those interested of these appliances and devices, and to give all available practical particulars to those who desire them. Particularly in connection with new navigational methods, it is clear that the interest of shipping companies must be enlisted before these appliances can be brought into general use, and here the question of finance also enters, because although they are of undoubted value, the initial cost of some of the appliances is large.

When, however, research and development have reached the stage where it becomes possible for the merchant ships to sail direct from port to port, without delay from fog, icebergs, or other floating (or fixed) dangers to navigation, none will be found to say that the energy and money expended during the war towards defeating the enemy has not been turned to good account.

LEADER GEAR.

The first and probably the simplest device to improve the usual navigational methods is known as the "Leader Gear." The object of the gear is to guide a ship along a winding or narrow channel by following an electric cable laid on the bottom of the channel. This cable is fed with alternating current and suitable receiving gear is installed, temporarily or permanently, on the vessel, and aural or visual means provided, for ascertaining on which side of the cable the course of the vessel lies. In the dark, or in foggy weather, when buoys, lightships, landmarks, etc., are obscured, the pilot can, by use of the Leader cable and the receiving apparatus connected to indicating instruments on the bridge, steer the ship safely into harbour. In war-time, the uses of the Leader cable are many. A squadron of vessels retiring from a raid may find itself prevented from entering harbour by a heavy fog, when delay may result in serious danger from enemy submarines. A submarine may guide itself safely through the channel in a mine-field, without coming to the surface to take bearings or in any way giving an indication of its presence. War-time research has turned the Leader Gear from a mere idea into a practical device, and Leader cables up to forty miles in length are now in working order.

It is true that we are still without complete knowledge regarding the fundamental physical constants involved, which would enable the best frequency to be chosen for any cable and the best form of receiving apparatus to be designed for the ship, and further research is vitally important. It is more than probable, however, that science will shortly devise an efficient and reliable instrument which can be fixed on the bridge of a vessel and will show the pilot directly how he must steer to follow the safe channel into harbour, while the cable itself will be self-indicating, so as not to be confused with other cables following a different course. When Leader Gear has progressed to such a stage that "in" and "out" lanes of traffic are established in all congested areas, shipping will have real cause to bless the circumstances which forced the development of this navigational appliance.

WIRELESS TELEGRAPHY AND TELEPHONY.

It is well known that enormous advances were made during the war in connection with the development of Wireless Telegraphy and Telephony, and probably the most fundamental change is that from the spark system to what is known as the continuous wave system. In the spark system, the signals are given out by what might be described as a series of splashes in the ether, and it is the sequence of these splashes which is heard as a note in the telephone at the receiving station. With continuous waves, on the contrary, a series of ripples of equal height are produced; these ripples, following one another at regular but extremely short intervals, are much above the range of audibility, and it is due to this fact that the development of Wireless Telephony has made such enormous strides. It is also owing to the regular sequence of the ripples that receiving and transmitting instruments can now be tuned with much greater accuracy, and that more efficient methods of receiving can be used, than in the older spark system. Before the war, the methods of producing continuous waves were cumbersome, costly, and comparatively unreliable, but through much patient research a small instrument has been developed known as the "three-electrode ionic valve" (or, more shortly, "valve") which has superseded previous appliances. This is a device resembling an electric lamp, but having inside the globe extra attachments known as the "plate" and "grid," which are descriptive terms. When working, the valve filament is illuminated like an electric lamp, and, according to the type of valve and the external electric circuits to which it is connected, it becomes capable of emitting continuous waves of various frequencies. A similar, but smaller, valve has been developed in order to deal with received waves, and to magnify signals received from other continuous wave or spark stations.

Much pioneer work on valves was carried out by the French, but the Admiralty have perfected certain types which are now capable of magnifying received currents tens, or even hundreds, of thousands of times with great reliability, so that it is possible for the magnified signals from a distant station to operate tape machines or other mechanical recorders, so that messages may be printed or otherwise recorded on tape. It is the valve which has made Wireless Telephony a practical proposition, and it is now possible to speak across the Atlantic with instruments which a few years ago would have appeared incredibly small. Much research will yet have to be done, however, before the final form of the large-sized transmitting valve is decided upon.

We have heard from time to time accounts of the uses of "directional wireless," or the wireless direction finder. This again depends on the use of valves for its practical value, since it is by their aid that very small aerials can be used. The popular idea of a wireless aerial is a vast erection on immovable high masts,—the height and size being necessary in order to increase the strength of the signals. In directional wireless receivers, a very small aerial is used, and in one form it consists of a few turns of wire mounted on a small rotatable frame a few feet square. With an amplifier, loud signals can be received on even this small aerial and, what is more, the direction of the station which is transmitting can be determined simply by turning the frame, for it is found that in certain positions the signals are strongest, while at right angles they are of minimum strength. Small frames like this give indications of bearing which, under favourable conditions, are accurate to about a degree, but there are disturbing factors which may result in a bending of the wireless waves, causing errors in the bearing. More information is required regarding the cause of these errors and how to avoid their consequences, but already the method is of practical value, for it is clear that a ship can determine its position merely by taking the bearings of two known transmitting stations. In war, the method was so perfected that every ship, submarine, or aircraft which dared to use its wireless set in an enemy area, stood in grave danger of having its position ascertained by directional wireless and had to face the possibly unpleasant consequences following upon this knowledge. Other methods of ascertaining the position of a ship by wireless are available. In some, special wireless apparatus is required in the ship, while in other methods, only the ordinary wireless transmitting and receiving gear is required; time alone will show which of these methods is the more convenient for general use.

Considering the achievements of the last few years in this direction, it will be remarkable if the end of the next decade does not find us with this additional safeguard for navigation perfected and in daily use by the majority of ships and aircraft.

SOUND-RANGING.

Early in the war the Army Authorities developed apparatus for locating the positions of enemy guns by means of instruments which recorded the instant of arrival of the explosion wave in the air. Microphones were stationed at accurately surveyed points, and were connected to electrical recorders which gave the required indications photographically and with very great accuracy, but, in the earlier forms, only after considerable delay. From the time-indications, the position of the gun could be calculated, the speed of sound in air being known. From a Naval point of view, it was of great value to know when, for instance, an explosion occurred in an enemy minefield, or one of our own, and to know the exact position of the explosion. A microphone method, similar to that used by the Army, was devised for use in the sea, and it was found that the detonation of a small charge (2 lbs.) of T.N.T. under water could be recorded at a distance of 14 miles, while it is probable that the explosion of a moderate charge would now give indications as far away as three or four hundred miles.

The problem of sound-ranging under water is more difficult than that in air, and one reason for this is that the greater speed of sound in water makes any error in the time of greater consequence. Lately, however, a perfected design of time-recorder has been produced, and on this the time-intervals can be read immediately on dials correct to about one-thousandth of a second. Apparatus for calculating the position of the explosion is also being experimented with, in order to lessen the time which elapses before the origin of the pressure wave is located. Great advances have also been made in the microphones which are used for sound-ranging purposes, and, in the latest form of the device, single point contacts are used and an extremely sensitive setting is obtained by employing a hollow silver-covered iron ball floating with perfectly neutral buoyancy in a fluid, and held magnetically in very light contact with the diaphragm which receives the explosion wave. This instrument can be re-set by the shore operator so as to be ready for a second record.

The navigational possibilities of this device do not need to be emphasised, for it is clear that a ship can be informed of its position (by wireless) within a few seconds of its dropping the charge; no warning is needed as the recording apparatus is self-starting and everything is done automatically. Very great accuracy is already attainable,—far better locations of the ship's position being given than is possible by astronomical methods. The simple method outlined above can, with advantage in certain circumstances, be combined with other means of transmitting signals, for example wireless, so that the distance can be calculated directly from the difference in time of arrival of the two signals and the known velocities of propagation of the two waves. Even greater accuracy should be attainable in the future, as soon as more information is available regarding the variation of sound velocity in water with temperature, pressure, and salinity.

HYDROPHONES.

This chapter would be incomplete without reference to the hydrophones which, in different forms, were used to detect the sounds made by an enemy submarine in motion, and later to determine the direction. Early in the war, hydrophones were moored in harbour entrances and were electrically connected to listening stations on shore, where passing traffic, whether submerged or on the surface, could be heard. Hydrophones were later made for use on board ship, but great difficulties were encountered owing to the noises produced by the water running past the diaphragm, as the faint sound of the enemy vessel was masked. In an improved form, the hydrophones were enclosed in stream-line bodies which were towed astern of the ship, and successful listening could be carried out with these at greater speed, while the addition of a certain "bias" to the diaphragm of the hydrophone rendered the instrument "directional," so that the hydrophone responded to a maximum degree in certain azimuths and to a minimum degree in directions at right angles.

In such a brief *résumé*, it is not possible to give more than a vague general outline of the course pursued in work on any of the devices mentioned. It will, however, be realised that acoustic methods of detection were among those first investigated, as these appeared most likely to provide a suitable weapon for use against the invisible submarine, and numerous devices for listening to water-borne sounds were tried. The Portable Directional Hydrophone which promised important results when used by numbers of trawlers, drifters, and anti-submarine craft, was the outcome of a vast amount of painstaking work, and involved researches upon such subjects as the effect upon the efficiency of the instrument of the size, shape, thickness, and general physical properties of the diaphragm, the depth of submergence of the hydrophone, the vibration of the small microphone capsule, and the material, size, and position of the plate used to produce the "bias" referred to above. Even after all this work, when materials and constructional details had been standardised with the greatest care, it was found that of two instruments which were apparently identical, one was efficient and the other worthless, so puzzling and insufficiently understood were the problems involved. Moreover, it was not exactly known from what source the noise of a submarine originated, or its character, and experiments had to be made in order to determine these points. We have advanced far beyond the stage of 1914, when a certain Government official, a scientific man and a musician, placed his head in the sea and came up humming the notes which were produced in the water by the vibration of the blades of the propellers of a submarine when struck by hammer blows. Now we are developing instruments which will measure accurately the amount of energy emitted at different frequencies by any source of sound under water, thus enabling the efficiency of different types of acoustic devices to be compared with precision.

ECHO METHODS.

The modern submarine is a quiet vessel, and even the best hydrophones may now fail at moderate ranges because there is so little sound to detect. Hence scientists have attempted, with a certain success, what are known as "acoustic echo" methods of detection. In these methods a sound is made under water either by a small explosion, by a hammer blow on a diaphragm, or by a water siren, while the operator listens with a hydrophone or similar instrument for the echo which will come back from any suitable object lying in the water, whose presence will thus be revealed. Many difficulties have been met in the development of this method, but its possibilities in connection with navigation are evident if icebergs, wrecks, rocks, or other ships can be made to give an indication of their existence and direction, especially during foggy weather. An interesting development of this principle has already been experimented with for depth sounding. The apparatus comprises a transmitter similar to that already mentioned, and an electrically recording receiver which shows how long an interval has elapsed between the production of the original sound and the return of the echo from the bottom. We know how fast sound travels in water and can easily calculate the depth of water, once the time is known. Soundings can quickly be made by this method, without the labour and waste of time involved in reeling and unreeling perhaps hundreds of fathoms of wire. There seems every probability that we shall shortly be in possession of a simple instrument which will indicate the exact depth of water under a ship, simply by pressing a button.

UNDERWATER EXPLOSIONS.

The damaging effect of a submarine explosion clearly depends in some way upon the depth and quantity of explosive used and the distance of the object from the charge. This knowledge is not sufficient, however, for on second thoughts one realises that an explosion in which the pressure rises very rapidly to a large value and again falls rapidly may produce greater damage to the hull of a ship than a less violent but more prolonged explosion, while the difference between these two cases is not necessarily dependent on the quantity or quality of the explosive. Before the war, the methods used in comparing explosions were what is known as "empirical,"—in non-scientific language they were rather haphazard and inaccurate. In the war, when great numbers of mines were being laid and the call was always for more explosive, it became a matter of great importance to know exactly how to allot the quantity available to the greatest advantage. Accordingly a research was undertaken with the object of determining exactly what pressure was exerted by various weights of charge at different distances, and how the pressure varied with the time. Various methods were proposed. Of these, one has given a very complete series of results, while others are being experimented with, in view of the necessity for comparing and checking the results given by the first method. To illustrate the kind of results which have been obtained, it was found that with a charge of 300 lbs. of amatol, submerged 50 ft., the pressure 50 ft. away rose in one ten-thousandth part of a second to something like one ton per square inch and vanished again after about one two-hundredth of a second. With gunpowder, the explosions were much more prolonged and the maximum pressure was more slowly reached. The values were calculated from measurements of the amount of crushing experienced by small copper cylinders, placed behind pistons of various sizes which were acted upon by the force of the explosion. By means of this device, it was possible to calculate the relation between time and pressure during an explosion, at any distance from the charge.

THE ELECTRIC SEARCH GEAR.

During the war much research was carried out on electrical methods of detecting submarines, as it was to be expected that a large mass of metal might be capable of detection by the alteration it would cause in an electric field produced artificially in the water. In one of these methods it was proposed, in essence, to send a large electric current through the water by means of two conductors or electrodes, which were towed by cables behind a ship, and which were fed with current from generators on the ship. Two or more other electrodes were also towed behind the ship, and these were connected to delicate electrical appliances on board for the purpose of recording any current flowing through them. It was expected that a submarine would disturb the course of the current, and that the electrical instruments on board would register this change. In point of fact, the change could be detected and a submarine located by this method, but there are too often other disturbing forces which give fictitious indications and make the results unreliable.

It was found in the course of the work with detection apparatus of this kind that the indications depended, among other things, upon such variable factors as the speed and course of the towing ship, the temperature, depth, and salinity of the water, and also upon small inconsistencies in the electrodes. Until all these points have been separately examined, and means of allowing for them have been worked out, so that the recording instruments give an indication which affords indubitable evidence of the presence of a submarine, this form of search apparatus cannot be considered reliable.

Even though this type of apparatus was not brought into successful use for the purpose intended, it has already been shown that the electrode gear has great commercial possibilities, apart from the obvious one of locating wrecks. At the beginning of 1920, the Admiralty were approached by one of the Cable Companies who stated that one of their cables had broken down and suggested a trial of the Leader Gear method for locating the fault. The position of the fault was not indicated with certainty by the ordinary methods, but was believed to be somewhere near the crossing points of numerous other cables, so that dredging operations would have to be very carefully carried out to avoid interruption in the working of the other cables. A suggestion was made to use the Electrode Gear—minus, of course, all the heavy machinery necessary for its use in the manner described above—and the trials were commenced. The faulty cable was fed with electric current broken into recognisable signals, and the Electrode Gear was towed in the suspected area of the break until the distinctive signals were picked up. The operators could not only recognise when they were over the right cable but they were able to follow it up to the break. A buoy was dropped to mark the spot and the cable was brought up by a diver. It was then found that the fault lay within a few yards of the buoy, though the ordinary methods had suggested a position much further out to sea. By the use of Electrode Gear, a waste of time and money was avoided, and the engineers who witnessed the search were impressed with the possibilites of further developments.

One point which is of distinct scientific interest was discovered accidentally while investigating some of the irregularities observed in the indications of the Electrode Gear. Electrical currents of varying strength and direction were found to exist in the sea, and these were shown to depend upon the strength and direction of the tidal currents. Theory points to the currents being caused by the motion of the water in the earth's magnetic field, and further investigation is desirable, as movements of sea-water may have important consequences in connection with submarine telegraphy.

HELIUM.

This element is one of the gases which form part of our atmosphere, though it is present only in the very minutest quantities. Helium belongs to the scientifically important group of inert gases, which make no chemical compounds whatever. It was first discovered in the sun, later found to be a constituent of the earth's atmosphere, and finally proved to be an element formed during the process of radioactive disintegration, during which one radioactive element spontaneously transforms itself into other elements, thereby justifying the faith of the ancient alchemists in the transformation of matter. Early in the war, the Admiralty recognised that its inability to form chemical compounds, together with its lightness, which is comparable with that of hydrogen, would render it an admirable gas for filling airships, if only it could be supplied in sufficient quantities and at a sufficiently low cost. Before the war, the cost of helium was prohibitive, and it was difficult to obtain in sufficient amount even for research work, so that it remained an interesting rarity. Now, owing to the work of an extremely able body of enthusiasts by whom certain natural gas wells in Canada have been exploited for their helium-bearing properties, it has been proved that its production in large quantities at a low cost is possible. Apart from its obvious advantages as a filling for balloons and airships, it is probable that other scientific and technical uses will be found for helium when it is available in quantity. Very recently some most remarkable results have been obtained in experiments carried out at low temperatures, and it is probable that helium will find its immediate application in research of this kind, since, by its use, a near approach can be made to the lowest possible temperature. Among other uses one might suggest its value for filling wireless valves and high-tension switches, but it is true that many years may elapse before there is any commercial demand for helium on the scale in which a brilliant war-time research has shown it can be supplied.

THE FUTURE.

From what has been written earlier in this chapter, the writer hopes that two facts will stand out prominently. These facts are not the wonder of the things achieved by scientific men and the workers assisting them, or the vast amount of patient thought and planning which have preceded, and always must precede, success in science. Attention has rather been drawn to the remarkable manner in which those devices which are already "in being," and which are the outcome of ideas used directly in the late war towards the destruction of life and property, can be made to play their part in the restoration of commercial activity and the safeguarding of human life. They were designed to destroy; they remain to rebuild the fabric of civilisation. Emphasis has also been laid upon the value of even those researches which are of the most academic description, for pure research gives a "line" to the practical worker; it gives him a theory on which to build up his work, and without a theory experimental work in any fresh field can be nothing more than a series of shots in the dark, each shot having a very small chance of reaching the target. Our great research workers have served us better than they knew. Knowledge they won in the desire to unravel more of the complex secrets of nature, has been turned to practical advantage, as must always happen sooner or later. Who, for instance, could have foreseen the practical application of those wonderful experiments carried out some years ago at Cambridge, where famous men busied themselves with measuring, weighing, and timing the flight of the then newly discovered electron? Yet it is the electron theories which have been the origin of all progress in the valves which have revolutionised wireless telegraphy and telephony. It is the electrons themselves, almost incredibly minute and swift, which produce the effects by which signals are sent through space. What chemist can foretell the uses to which some newly discovered laboratory curiosity will be put? Rare elements whose names were scarcely heard outside the lecture room a few years ago, now form important components of valuable engineering steels. These are only single instances of a general proposition, that no work which produces fresh knowledge can ever be wasted. In the future, the Navy will itself possess a Research Laboratory in which it can carry out research on those lines which bear directly on the problems confronting it, and which must be solved if Britain is to retain her position as mistress of the seas.

Great Britain is an island, and yet it is true that, in a scientific sense, we know next to nothing of the physics of the sea. We know a little more than we did before the war, but the knowledge we have gained in this and other subjects shows us what gaps remain to be filled, and we may rest assured that the results of the work which will be carried out in the new Naval Research Laboratory will not only benefit the Navy, but the whole Mercantile Marine of the Empire.

J. BUCKINGHAM.

CHAPTER VIII.

THE NECESSITY FOR THE NAVAL STAFF UNDER PEACE CONDITIONS.

THE idea of a Staff is not purely naval nor military. A staff of some sort is found in every business of any size, and it is not too much to say that the principles underlying the Naval Staff will be found incorporated in some form or other in all large industries. If given a very general application, the word may be used in the sense of anybody who assists in a particular service (*e.g.* a staff of servants, the ground staff at the Oval), but at its root lies the idea of mutual service or "team work" to a common end.

It is, however, usual when we speak of a Staff in its military sense, to attach to it a more particular meaning; we imply the body of officers who help the Admiral or General in directing operations, and in the administration of his forces. To give a concrete example —the function of the Staff of an Admiral at sea is as follows: (1) To collect and keep in a readily accessible form for him all particulars and information which he may require in making decisions. (2) To work out in detail the instructions necessary for the execution of those decisions, and to ensure that the administrative services of supply and equipment are prepared accordingly. (3) To ensure that the instructions governing the training of the personnel in the command are in accordance with the principles laid down by the Admiral, and fully meet his strategical and tactical requirements.

In war time the work of the Admiral, and therefore also that of his Staff, is primarily to plan and carry out operations against the enemy. In peace time it takes the form of planning and preparing for war. Training of the personnel and the ordinary daily work of administration and maintenance of material, has to be done both in peace and war, and its due and proper performance is a matter of importance.

War experience, Naval and Military, has shown that for efficiency the work of operations, planning, and training, on the one side, and the work of administration, including discipline, supply, and equipment, on the other, should not be dealt with by the same body of officers; otherwise the former becomes swamped by the detail of the latter, and both aspects of the work are neglected accordingly. The Staff of an Admiral has, therefore, been divided into two separate sides: (1) The War Staff, (2) The Technical and Administrative Staff, which, whilst maintaining the closest touch, and each understanding the requirements of the other, are nevertheless separate and distinct and in a position each to attend to its own sphere of duties. This principle is carried out not only in the commands afloat, but at the Admiralty. Broadly speaking, the Naval Staff at the Admiralty under the Chief of Naval Staff, who is also the First Sea Lord, corresponds to the War Staff of the Admiral at sea, and is not concerned with the actual work in connection with the provision of personnel or of design and supply, which duties are carried out by Directorates under the Second, Third, and Fourth Sea Lords. The above organisation is designed to meet our requirements in war and to ensure that, during peace, proper preparation and provision will be made. As already stated, it has been evolved as a result of war experience, but in addition it is based on the teaching of history.

EXPERIENCE FROM THE PAST.

The system of separating the functions of fighting from those of supply was followed by the statesmen of the 17th and 18th centuries, and it was on this principle that the wars of Blake, Hawke, and Nelson were fought. In those days the Office of the Admiralty and the Navy Office were distinct; that is, the principle of keeping the conduct of Operations distinct from Supply was adhered to, although its real significance may not have been as fully realised by those concerned as it was later by Moltke, who when building up the Staff system for the German Army, is said to have insisted on the Great General Staff being housed in a building at least two miles from that containing the Departments responsible for Maintenance and Supply. Owing to causes independent of the principles enunciated above, the efficiency of the Navy Office was seriously impaired by bribery and corruption. This ultimately led Sir James Graham, in 1832, to merge the Navy Office in the Admiralty; the Admiralty swallowed up the Navy Office, with the result that the ever-increasing detail work of supply and administration gradually assumed more and more importance within the Admiralty to the exclusion of the more abstract work of planning and preparation for war. As an example, we may quote the case of a First Sea Lord who spent days of his time and much ink over a knotty point relating to the design of spoons and forks for boys' training ships. This is rather an extreme case, but there is no doubt that the fusion of the two offices led to successive First Sea Lords being overwhelmed with questions of detail and unable to devote their full attention to the subjects of chief concern, namely, naval policy and war efficiency.

The immense strides in the development of ships and guns, the transition from sail to steam, absorbed their time and attention. Material developed to the exclusion of strategy and tactics. As it developed, owing to the outstanding talents of the many admirable men of the day, it became their chief thought, and its use for actual fighting was not fully studied. Officers became immersed in material problems to the exclusion of the study of naval war. The gun became master of the tactician instead of his servant; and the power and size of the weapon developed faster than the study of its use. This era exalted mathematics and mechanics to the highest pinnacle of naval opinion. Owing to the lack of an organised thinking body, study of the use of weapons as distinct from their manufacture was neglected, with the corollary that the necessity for practice and experiment in their use was not realised. Neglect to employ the personnel in practising for war made it necessary to invent some other employment, especially when the work connected with masts and sails ceased to exist; and led inevitably to a great expenditure of energy on work entirely divorced from the ultimate requirements of war.

Towards the end of the last century it began gradually to be realised that there was something wrong, and that until a new system was inaugurated, the brains of even the most brilliant individuals would be unable to achieve the requisite preparation for war. In the foundation of a Naval Intelligence Department in 1887 we see the beginnings of a Naval Staff. The writings of Mahan directed attention to the study of war. In 1900 a War College was opened at Greenwich, but it was not until 1912 that an Admiralty Naval Staff, then entitled the Naval War Staff, was instituted under one head with a definite organisation and an appropriate course of training.

Even this small beginning, a description of which will be found in Mr. Churchill's "Memorandum on a Naval War Staff," published with the Navy Estimates of 1912-13,* met with criticism, and the necessity for a body of officers specially trained and dealing only with war preparation was by no means generally appreciated. We therefore find that it was really only the nucleus of a Staff which existed between the years 1912-14, and moreover the adoption of the principle of the separation of staff work from administration stopped short of the Sea Lords, in the duties of each of whom staff work and administration were still intermingled.

WAR EXPERIENCE.

At the outbreak of war, the Naval Staff at the Admiralty consisted of three small divisions: (1) Intelligence, (2) Operations, (3) Mobilisation. This Staff was presided over by a flag officer, who was not, however, a member of the Board. It soon became evident that this organisation did not cover the whole work of preparation and conduct of war; and, further, being separate and unrepresented on the Board of Admiralty, full advantage was not taken of the scope of its work. In 1917, however, when Lord Jellicoe was at the Admiralty, an extensive re-organisation was made. The First Sea Lord himself became Chief of the Naval Staff; the former Chief of the Staff became Deputy Chief of Naval Staff, and he and a newly appointed Assistant Chief of Naval Staff were constituted members of the Board, thus ensuring an adequate representation on the Board of Admiralty for those dealing with the conduct of operations of war.

The Board of Admiralty retained its constitutional responsibility, but its internal constitution was somewhat altered. Its members were grouped into two Committees, Operations and Maintenance, and the work was distributed under these two heads, the First Lord acting as President of both Committees, and the Secretary attending to the meetings of both. The Operations Committee consisted of the First Sea Lord, the Deputy Chief of Naval Staff, Assistant Chief of Naval Staff, and Deputy First Sea Lord, an office which had been added to the Board a short time before. The Maintenance Committee consisted of the remainder of the Board—Second, Third, and Fourth Sea Lords, Civil Lord, and Parliamentary Secretary. The Staff was also largely expanded to meet the requirements, which war had shown to be necessary; and at the conclusion of the war consisted of eleven new divisions, in addition to the original Intelligence and Operations Divisions.*

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* See the "Naval Annual," 1912, p. 385.

The Divisions existing at the Armistice were: (1) Plans. (2*a*) Operations (Home). (2*b*) Operations (Foreign). (3) Intelligence. (4) Training and Staff Duties. (5) Trade. (6*a*) Mercantile movements. (6*b*) Troop movements. (7) Mine-sweeping. (8) Anti-submarine. (9) Signals. (10) Air. (11) Gunnery and Torpedo.

This re-organisation and expansion must be regarded as the final result of war experience, and amply fulfilled the expectations formed of it. It was not the product of a theorist, but was stamped out by the reality of war. It was the realisation of the principle, all too hesitatingly accepted, that the chief of any big business should only consider the large problems of business and that all details should be worked out by subordinates. Lack of sufficient or properly trained subordinates results in the chief being overloaded with matters of detail. This principle, in conjunction with another, namely, the differentiation of Operations and Supply, is the fundamental basis of Staff Organisation, and the result of the re-organisation, stated briefly, was that the Chief of the Naval Staff was able to give his undivided attention to the larger questions appertaining to the conduct of the war.

Naval Staff in Peace.

It has not been considered necessary to argue at length the necessity for the Naval Staff in war; the war proved it, and the above is a mere statement of its development and expansion. It is equally necessary in peace time. The Staff is then required: (*a*) To provide a Staff organisation ready and existent on the outbreak of war. (*b*) To prepare plans and make all preparations necessary for the contingency of war and to investigate and study all the aspects of war. (*c*) To study the use of all weapons and to supervise their continual development.

With regard to the provision of a staff organisation ready on the outbreak of war, it will be admitted that the British Government would be considered mad if they said: "Now that the war is over, we will abolish the Navy; we will leave a few merchant ships flying the white ensign to show the flag; the warships can all be sold; it will be time enough when the next war breaks out to create a Navy." Obviously, it is absurd to imagine that a Navy can be created on the spur of the moment, and it is equally absurd to expect to create an efficient Naval Staff on the outbreak of war. It is no doubt easier to grasp material considerations than those of a more abstract nature. Any one can see that it is physically impossible to build a fleet in a day, but there may be some who think that the creation of a body to direct such a fleet is merely a question of collecting a certain number of officers into a building and calling them a Staff or Board.

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* The Mobilisation Department was detached from the Naval Staff and passed over to the Maintenance side.

But this is far from being the case. No Staff will function in war unless the officers appointed to it have studied in peace time the war problems involved. This necessitates not only special training of the officers who are selected for staff work, but also that they shall be appointed in peace time to carry through the preparation of the war plans, and supervise the training of the personnel.

To expand the above argument in greater detail, it must be understood that preparation for war, so far as the Naval Staff is concerned, consists of: (1) The preparation of plans. (2) The study of the use of the fleet and its weapons. (3) The training of the fleet.

The responsibility for War Plans rests with the First Sea Lord. It is obviously an impossible task for one man, for it embodies practically every sphere of activity in the Empire.

Before beginning to make a plan it is necessary to have the requisite information, strategical, tactical, and technical. Therefore the first function of the Staff is to collect information. The Intelligence Division performs a large portion of this work, but not all, for a considerable amount of experience is embodied in the fleet itself, and a further mass of information dealing with the work of all branches during the war has been accumulated in each Division and Department of the Admiralty. Owing to the complexity of modern warfare, the field to be covered in the collection of information and knowledge is vast and ever changing. It is the business of the Naval Staff to collate this information, and in all questions of naval war to act as the remembrancer of the Board, and more particularly of the Chief of the Naval Staff. The Plans Division and Operations Division are the two chiefly concerned with the actual initiation and preparation of war plans. They are assisted by all the other Divisions, in some cases merely by the supply of data, and in others by the actual development of special portions of the plans. For instance, under the present organisation of the Naval Staff, the detailed arrangements for the defence of bases, the study of localities for the establishment of bases, etc., fall to a special Division—the Local Defence Division. At the same time, it is not the business of the Naval Staff to make decisions; this is the function and duty of the Board. The Naval Staff merely presents all the considerations in a digested form to the Chief of Naval Staff and the Board, with whom the actual decision as to the adoption of specific plans or policy rests.

The policy and general plan having been decided by the Board, it is next the business of the Naval Staff to work out the schemes in greater detail. Firstly, supply and maintenance departments must be informed of the requirements in personnel and materiel; the Naval Staff being responsible for seeing that due economy is exercised in formulating such requirements. Secondly, the Naval Staff must work out the details regarding the organisation of squadrons and auxiliary services to meet the changing requirements of the current international situation, and Commanders-in-Chief and Flag Officers must be given instructions in regard to the war requirements of their particular command. Thirdly, principles of training must be formulated and the Commanders-in-Chief given full information. Constant supervision and infinite care in this training is a most important Staff function, for if not carefully supervised, the principles on which training is carried out may gradually become divorced from war requirements. Fourthly, new developments in weapons and methods of warfare must be constantly watched and fostered. Advantage must be taken of all new discoveries and inventions. It is the business of the Staff to point out in what directions research is most required; lines of experiment which are not likely to be of any practical war value must be checked and activities directed into useful channels. The above is an outline of the work to be done by the Staff, but this review would not be complete without drawing attention to the difference which exists between the Staff requirements of the present day and the past.

THE STAFF REQUIREMENTS OF THE PRESENT AND THE PAST.

The Staff requirements of the modern Navy are very different from those of the old sailing Navy. A hundred years ago movement at sea was very slow compared with the present day. Communications were immeasurably slower; there were no telegraphs, no wireless, and no short distance signals such as searchlights. Under such circumstances, the actual time taken to sum up a situation was as nothing compared with the length of time involved in carrying out the operation itself. Nowadays, the converse may be true; the time taken to perform an operation may be even less than that taken to plan it. A hundred years ago a naval commander, with the assistance of his secretary, was often able to work out his own appreciations, draft his own orders, and, at the same time, supervise his own command, but in these days any attempt on the part of one man to do all this work himself would lead to disaster. All the apparatus of war is more complex, and time, which is everything in war, is measured in seconds instead of minutes.

Even in the old days the need for a staff was dimly felt. In 1779 Kempenfelt wrote to Middleton (afterwards Lord Barham): "We are every day from morning till night plagued and muzzled in minutiæ whilst essentials are neglected." It is clear he was overwhelmed with the details of administration of the command instead of being free to consider the larger questions of its employment.

Enough has been said to demonstrate the necessity for a Naval Staff in peace. It is of no use to wait for "strained relations" before beginning to collect its personnel. The machine must already be in working order with trained officers to work it. It need not be so large in peace as in war, but it must be capable of expansion without dislocation, and therefore must not be contracted in peace to such an extent as to alter the functions of its components. Since the Armistice the Naval Staff has been reduced from thirteen to eight divisions—a number which is sufficient during peace; they are so grouped that in the event of war it will be a simple matter to expand them as necessary.

Cost is always a crucial point, so it may be mentioned that the cost of the Naval Staff under peace conditions is approximately equivalent to two-thirds of the annual upkeep cost of one light cruiser. It is therefore evident that the price of an adequate Staff, without which the Fleet cannot be efficiently controlled, is but a small fraction of the annual charge of the upkeep of the forces under control.

A STAFF OFFICER.

CHAPTER IX.

THE MISSION OF THE NAVY LEAGUE.

THE Navy League was formed in 1895. For more than twenty years previous to the outbreak of the Great War it carried out an active propagandist movement throughout the country, creating a public opinion in favour of maintaining a naval force sufficient to meet every possible requirement in relation to the defence and safety of the Empire. Eminent naval authorities have publicly stated that, but for the Navy League's activities, the British Fleet would not have been found in the strength and condition that it presented to the world in August, 1914.

With the cessation of hostilities and the disappearance of the German Fleet, a fuller and more comprehensive policy was adopted. While the League still retains and stands firmly by its original creed—that Britain's "Sure Shield" must always be found in the sufficiency and efficiency of its Fleet—it holds that the moment is now supremely opportune for developing and expanding its educational activities. No feature of our national life, unveiled by the Great War, is more strange or striking than the lack of knowledge exhibited by the majority of Englishmen in the history of the Sea Services, the meaning of Sea Power, and its scientific uses, alike in peace and war time. The Navy League is determined to do all in its power to inculcate into the minds of the coming generation the true meaning of the "Spirit of the Sea," and the effect of Sea Power upon history. By taking as its example the traditional spirit of Sacrifice and Service of the Royal Navy and Mercantile Marine, it aims at gradually building up a body of public opinion well qualified to pass a considered and informed judgment on matters of sea polity as they arise.

Commencing its activities in the Elementary and Secondary Schools, Prize Essay Competitions on Naval Subjects, it is hoped, will be set in every such school in the Kingdom. A signed Certificate of Merit will be awarded by the League to the writer of the best essay, of which the text will be chosen by the respective head teachers, with the approval of the League. The Certificate of Merit will, it is thought, be highly prized, representing as it does the evolution of the modern dreadnought, in an instructive and beautifully designed picture by Harold Wyllie, linking up the periods from 1573 to 1906. It is hoped in course of time, that, by this means, between seven and eight million children will annually be got into touch with, and instructed in, the history of the Sea Services. Beginning in a small way last year, over 1500 selected essays were received out of a very much larger number that competed.

Having finished his time at the Secondary Schools, the Navy League hopes to attract as many boys as possible to join its Sea Cadet Corps. Those who desire a sea career are helped to become good seamen, and in any case are taught discipline, duty, and self-respect in order to make them good citizens, and to educate them in believing in the British Empire and its Sea Services. The Navy League has at the present moment some three thousand boys in training; official recognition is now given by the Admiralty to its units, and their respective strengths are tabulated in the Navy List. In connection with this movement, and to test the proficiency of the various units, competitions are held annually in London, in squad, company, and physical drills, signalling, band, seamanship, and swimming. Flags and medals are awarded to the successful unit, and best boy representing his unit. In addition to the Sea Cadet Corps, the Navy League has affiliated to it several Training Ships for the training of boys for the Royal Navy and Mercantile Marine, and it is hoped largely to increase this movement as funds will permit.

RALLY OF THE DOMINIONS.

Soon after the Battle of Jutland, what is known as the Navy League Overseas Relief Fund was opened. It was the result of spontaneous donations sent by the overseas branches of the League, for the relief of widows and dependents of officers and men of the Royal Navy lost in that battle. Later the scope of the Fund was extended to include all widows and dependents of officers and men of the Royal Navy, Auxiliary Forces, and Mercantile Marine who had lost their lives, or been permanently injured, during their war service. The Committee administering the Fund have had a very free hand, and grants for many varying purposes have been made: temporary assistance pending settlement of pensions, sickness grants, help in removing and furnishing homes, clothing grants, special medical treatment, training, grants for emigration, assistance in starting businesses, and substantial grants have been made to the Royal Naval Maternity Homes at Chatham, Devonport, and Portsmouth, and also to the Seamen's Hostel at Dunkirk. The Committee have also assisted applicants to claim any Government grants to which they may have been entitled, and in many cases have supplemented them. The Fund has been of special benefit to the dependents of merchant seamen whose pensions have been very inadequate, and who were ineligible for assistance from practically all the large War Funds. Nearly 10,000 individual cases have already been investigated.

An Education Committee was also formed as an important branch of the Overseas Relief Fund, to assist in the education and advancement in life of all children of all ratings in the Royal Navy, Auxiliary Forces, and Mercantile Marine, who had made the supreme sacrifice. The scheme includes the payment of tuition fees, stationery, books, travelling, dinners at school, school clothes, and, in some cases, boarding fees and maintenance allowance during education. A substantial sum has been set aside to create a terminable annuity, which will be automatically exhausted in approximately ten years, by which it is hoped to provide for the education and advancement in life of some 1000 orphans at a time. About this number is actually now receiving educational assistance from the Fund, and 138 children have already been helped in completing their education.

Sub-Committees have been formed in the three ports, Chatham, Devonport, and Portsmouth, and in other centres the work is carried on with the assistance of the Local War Pensions Committees, the Soldiers' and Sailors' Families' Association, and the National Sailors' and Firemen's Union. The General Committee includes the Chairman of the Executive Committee of the Navy League, representatives of the Admiralty, Board of Education, Lower Deck, Overseas Dominions, and other funds.

The total amount subscribed since the Fund was opened up to December, 1919, has amounted to nearly £458,000. The Navy League considers it a great honour and privilege to have been entrusted with the administration of this Fund. It places on record on behalf of all those who have benefited by its distribution, its sincere and heart-felt thanks to the generous subscribers from overseas, who have contributed so liberally to the relief of the dependents of those who, through "sacrifice and service," have bequeathed to Britain a legacy of fame imperishable.

A Navy League in Each County.

A County System is now being actively undertaken by the Navy League, whereby it is hoped, in course of time, to have affiliated to the Head Office a local Navy League in each county in the Kingdom. Complete autonomy is given to each county to frame its own rules and elect its own officers, acceptance of the League's policy, of course, being essential. Hertfordshire has for some time been so organised, and a promising start has been made in Kent, Gloucester, Lancashire, and Yorkshire. By this means it is hoped very largely to increase the number of members of the League, and spread its doctrine throughout the Kingdom. A paid secretary is appointed by each county, and an agreed percentage of all receipts is remitted to Head Office, the bulk of its funds, however, remaining in the hands of the local committee.

The Navy League owes a debt of gratitude to its Overseas Branches, which it will find difficult to repay. The loyal and patriotic support received from every corner of the Dominions and Colonies throughout the long time of War, was beyond all praise. The League feels that the spirit of brotherhood was never more marked than now in demonstrating "Imperialism," and in wishing to spread the gospel of Sea Power, and its effect on the destiny of the Empire to every corner where Britain's flag is flown. In Australia, New Zealand, South Africa, and South America flourishing branches are to be found, and in Canada the Navy League of Canada, affiliated to the Head Office, with its many subsidiary branches, is one of the most prosperous institutions in the Dominion.

There are also branches in India, China, Japan, and the Federated Malay States. From one and all encouraging reports are received, and it is with gratification that the League realises that its extended policy is receiving hearty endorsement.

Public lectures on sea matters are arranged, whenever and wherever possible, either with or without lantern slides. At the present moment there is a large and growing demand for lecturers; lack of funds alone prevents them being provided. Indeed, the clamant need of the Navy League—with its popular illustrated organ "The Navy," as a monthly link between each member and the widespread movement in all parts of the world—is more members in order that it may worthily fulfil its mission.

The Navy League remains entirely outside party politics. It owes allegiance to no party. It exists to render the greatest service of which it is capable to the Empire. It desires to assist in the health, welfare, happiness, and education of the officers and men of the Royal Navy and Mercantile Marine and their dependents, in any way in its power. Its motto "Sacrifice and Service" has been adopted to emphasise the duty that Britain to-day expects of its sons.

V. Biscoe Tritton.

CHAPTER X.

BOOKS DEALING WITH THE GREAT WAR—NAVY AND MERCANTILE MARINE.

[*Published in Great Britain.*]

History of the Great War, based on Official Documents. Naval Operations. Vol. I.: To the Battle of the Falklands—Dec., 1914. [With a case of maps.] Sir Julian Corbett. London: Longmans.

The Admiralty, while supplying official documents and correspondence and returns, also captains' letters and ships' logs, do not accept responsibility for the statements made or opinions expressed by the author, Sir Julian Corbett.

Naval and Military Despatches relating to the Operations in the War. Pt. I. (Sept. to Nov., 1914); Pt. II. (Nov., 1914, to June, 1915); Pt. III. (July to Oct., 1915); Pt. IV. (Despatch of Sir I. Hamilton—Gallipoli and Suvla Bay); Pt. V. (Jan. to April, 1916); Pt. VI. (May to Dec., 1916); Pt. VII. (Dec., 1916, to July, 1917); Pt. VIII. (July, 1917, to June, 1918); Pt. IX. (July to Dec., 1918). London: H.M. Stationery Office.

Chronology of the War. Vols. I. and II. (1914–17). With separate vol. of maps. (In progress.) Published under the auspices of the Ministry of Information. London: Constable.

When completed this will provide a detailed record of events, naval and military, which may be taken as a standard work of reference.

Return of Losses of H.M. Ships and of Auxiliary Ships R.N., between Aug. 4, 1914, and Nov. 11, 1918.

Return of Auxiliary Patrol Vessels, Minesweepers, etc., lost between Aug., 1914, and Nov., 1918. London: H.M. Stationery Office. [Parliamentary Papers, published by Command, No. 200.]

Mercantile War Loss Book. London: *Syren and Shipping.*

Prizes of War, War Casualties and Vessels and Cargoes detained. Lloyd's Official List.

Documentary History of the War. Vols I., II., and IX. Diplomatic: Vols. III., IV., VII., XI.; Naval: Vols. V., VIII.; Military: Vols VI., X.; Overseas. (In progress). London: The *Times* Office.

History of the War. Vols. I. to XXI. (excluding index and map volumes). London: The *Times.*

Both the *Times* History of the War and Nelson's History were published as popular works serially during the war. Every effort was made to make them authentic, and they are fair and approximately accurate narratives of events, as notified in the press from time to time—the only then available sources of information. The final volumes of the *Times*' History bring the information down to the Peace settlements in 1920.

Nelson's History of the War. Vols. I. to XXIV. (completed). London: Nelson.

The Illustrated War News. Vols. I. to VIII. (Aug., 1914, to April, 1918). *Illustrated London News Office.*

The Illustrated War News was published weekly during the war until April, 1918. The series is mainly comprised of naval and military photographs permitted to appear by the censorship, with a limited number of reproductions of sketches by war artists and correspondents, and from naval officers then serving. As a photographic record of events the volumes are valuable, but, unfortunately, there is no index.

A Short History of the Great War. A. F. Pollard. London: Methuen.

Naval History of the War, with introductory chapters on "Modern War and Psychology," and "German and British Policy." Sir Henry Newbolt. London: Hodder & Stoughton.

The Grand Fleet, 1914–1916. Adm. of the Fleet Viscount Jellicoe. London: Cassell.

Deals with the events of Lord Jellicoe's term of command of the Grand Fleet, and is of permanent historic value as a record and general narrative of the highest authority. It is at the same time critical in its treatment, and, on occasion, very outspoken as to official shortcomings. The tactics of the Battle of Jutland are fully discussed, with the aid of charts and plans, and the critical evolutions are explained, from the Commander-in-Chief's point of view, in considerable detail.

The Crisis of the Naval War. Adm. of the Fleet Viscount Jellicoe. London: Cassell.

Is concerned primarily and principally with events and incidents at the Admiralty during Lord Jellicoe's tenure of office as First Sea Lord on his quitting the command of the Grand Fleet. Much important and interesting information is given in regard to the organisation and development of the anti-submarine plan of campaign for safeguarding overseas food supplies and transport.

"My Memoirs." Grand Adm. von Tirpitz. (Translation.) London: Hurst & Blackett.

A record and defence at considerable length of his administrative work at the German Marine Department, Berlin, before the war and during its earlier phases down to the time of his supersession. Considerable light is thrown on certain matters of internal organisation in the German Navy, and informing details are given in regard to German Naval programmes, ship-construction, and armament questions. The submarine campaign plans, and the Kaiser's influence and interference in naval questions are dealt with very frankly.

Germany's High Sea Fleet in the Great War. Adm. Scheer. (Translation.) London: Cassell.

Admiral Scheer was in command of the High Seas Fleet previous to the Battle of Jutland—from January, 1916. He was in command in the battle, and his work may be accepted as authoritative and a comprehensive and generally accurate statement as to what took place on the enemy's side, as well as of events at Kiel and Wilhelmshaven during the period preceding the armistice.

"My War Memories." Gen. von Ludendorff. (Translation.) London: Hutchinson.

General Ludendorff's "War Memories" have a special value on the naval side as evidencing the attitude of the authorities and Higher Command in regard to the German anti-submarine campaign.

Germany's Naval Plan against Great Britain and the United States. [Operationen über See. von Edelsheim. (Translated by A. Gray.)] London: Hodder & Stoughton.

The Navy and the War. Sir J. R. Thursfield. Oxford University Press.

The Navy as a Fighting Machine. Rr. Adm. B. A. Fiske, U.S.N. London: H. Rees.

The Navy in Battle. A. H. Pollen. London: Chatto & Windus.

Sea, Land and Air Strategy: A Comparison. Col. Sir G. Aston. London: Murray.

Three Years of Naval Warfare. R. H. Gibson. London: Heinemann.

The British Fleet in the Great War. Archibald Hurd. London: Constable.

Sons of Admiralty—A Short History of the Naval War. Archibald Hurd and H. H. Bashford. London: Constable.

Sea Power and Freedom. Gerard Fiennes. London: Skeffington.

The Achievement of the British Fleet in the Great War. J. Leyland. London: Hodder & Stoughton.

The Freedom of the Seas. The History of a German Trap. M. Cababé. London: Murray.

Records. Adm. of the Fleet Lord Fisher. London: Hodder & Stougton.

Memories. Adm. of the Fleet Lord Fisher. London: Hodder & Stoughton.

Fifty Years in the Royal Navy. Adm. Sir Percy Scott. London: Murray.

Lord Fisher's "Records" and "Memories" and Sir Percy Scott's Autobiography are of incidental value as dealing with various events and questions which came before the officers in question while holding office during the war. Their personal views and opinions and comments are informative.

The Life of Admiral Mahan. Charles Carlisle Taylor. London: John Murray.

Contains interesting details of Admiral Mahan's views and opinions in regard to Great Britain and Germany in naval affairs before the war and on events of the war at sea.

The Life of Lord Kitchener. Sir George Arthur. London: Macmillan.

The third volume of Lord Kitchener's "Life" is of naval interest in particular by reason of the then War Minister's relations with Mr. Winston Churchill while First Lord of the Admiralty, and in regard to the inception of the Dardanelles Expedition.

The Great Naval Battle. A. H. Pollen. London: Chatto & Windus.

Falklands, Jutland and the Bight. With an introduction by Sir David Beatty. Com. the Hon. E. B. S. Bingham, V.C., R.N. London: Murray.

The Battle of the Falkland Islands—Before and After. Com. H. Spencer-Cooper, R.N. London: Cassell.

The Battle of Jutland Bank. The Despatches of Adm. Sir J. Jellicoe and Vice-Adm. Sir D. Beatty. Edited by C. S. Terry. Oxford University Press.

The Battle of Jutland: retold from Viscount Jellicoe's book. Foreword by Adm. Sir Cyprian Bridge. London: The St. Catherine Press.

The Battle of Jutland. The Sowing and the Reaping. Com. Carlyon Bellairs, R.N., M.P. London: Hodder & Stoughton.

The Battle of Jutland. J. Buchan. London: Nelson.

Ostend and Zeebrugge: April 23, May 10, 1918. The Despatches of Vice-Adm. Sir Roger Keyes and other narratives of the Operation. Edited by C. S. Terry. Oxford University Press.

The Glory of Zeebrugge and of the "Vindictive." With the Official Narrative of the Operations. Lieut. J. K. Bell. London: Chatto & Windus.

The Dover Patrol, 1915–1917. Adm. Sir Reginald Bacon. 2 vols. London: Hutchinson.

Sir Reginald Bacon's book comprises a full and detailed account of the Belgian Coast operations during the period of Admiral Bacon's command, as well as of the elaborate and carefully planned measures carried out to ensure a security of the communications with Northern France. His scheme and arrangements for the final and complete blocking of Zeebrugge and Ostend harbours are described in detail as worked out.

Keeping the Seas. Capt. E. R. G. R. Evans, R.N. London: Sampson Low.

Dover during the Dark Days. Lt.-Com. W. Coxon. London: Lane.

Dover and the Great War. J. B. Firth. Dover: Leney.

The Harwich Naval Forces. E. F. Knight. London: Hodder & Stoughton.

Despatches from the Dardanelles. Gen. Sir Ian Hamilton. London: Newnes.

My Gallipoli Diary. Gen. Sir Ian Hamilton. London: Arnold.

Useful information on the subject of the Navy's services and activities in connection with the Dardanelles operations will be found *passim* in Sir Ian Hamilton's "Diary."

The Dardanelles. Maj.-Gen. Sir C. E. Callwell, K.C.B. London: Constable.

The Dardanelles Campaign. H. W. Nevinson. London: Nisbet.

The Truth about the Dardanelles. S. A. Moseley. London: Cassell.

Dardanelles Commission Reports. H.M. Stationery Office.

The Immortal Gamble and the Part played by H.M.S. Cornwallis. A. T. Stewart and C. J. E. Peshell. London: A. & C. Black.

Uncensored Letters from the Dardanelles. By a French Medical Officer of Le Corps Expéditionnaire d'Orient. London: Heinemann.

British Campaigns in the Nearer East, 1914–1918. E. Dane. London: Hodder & Stoughton.

Secrets of the Bosphorus. By Ambassador H. Morgenthall, Constantinople. London: Hutchinson.

The Navy in Mesopotamia. Conrad Cato. London: Constable.

The Navy Everywhere. Conrad Cato. London: Constable.

Written by a Paymaster Commander R.N.R., and of use as a general narrative of naval activities off East Africa and West Africa, and elsewhere on services of which there is no other record yet published.

On Four Fronts with the Royal Naval Division. G. Sparrow and J. N. M. Ross. London: Hodder & Stoughton.

The Work of the Royal Naval Reserve. London: Published by the *Yachting Monthly*.

Submarine Warfare of To-day. C. Domvile Fife. London: Sealey-Service.

Submarines and Sea-Power. C. Domvile Fife. London: Bell.

Murder at Sea. Archibald Hurd. London: Fisher Unwin.

The Story of Our Submarines. By "Klaxon." Edinburgh and London: Blackwood.

"Q" Boat Adventures. Lt.-Com. H. Auten, V.C., R.N.R. London: Jenkins.

The Paravane Adventure. L. Cope Cornford. London: Hodder & Stoughton.

U-Boat 202. The War Diary of a German Submarine (Com. Spiegel von Pekelsheim's U-Boot 202; translated by Capt. B. Domvile, R.N.). London: Melrose.

The Cruise of the "Thordis": Sinking an Enemy Submarine. London: Published by the *Syren and Shipping*.

The Voyage of the "Deutschland." Capt. P. König. London: Pearson.

Five Months on a German Raider. F. G. Trayes. London: Headley Bros.

The Fighting Fleets: Five Months of Active Service with the American Destroyers and their Allies in the War Zone. R. D. Paine. London: Constable.

A Merchant Fleet at War. Archibald Hurd. London: Cassell.

Merchant Adventurers: 1914–1918. F. A. Hook. London: A. & C. Black.

Ordeal by Sea: The Story of the British Seaman's Fight for Freedom. Archibald Hurd. London: Jarrold.

Merchantmen-at-Arms. D. W. Bone. London: Chatto & Windus.

The Merchant Seaman in the War. L. Cope Cornford. London: Hodder & Stoughton.

The Fleets behind the Fleet. W. MacN. Dixon. London: Hodder & Stoughton.

The Union Castle and the War: 1914–1919. E. F. Knight. London: U.C.M.S. Co.

By Sea and Land: Some Naval Doings. Lt.-Com. E. Hilton Young, R.N.V.R. London: Jack.

The Naval Front. J. S. Maxwell and D. Maxwell. London: A. & C. Black.

The Seafarers. Major A. Corbett Smith. London: Cassell.

The Fleet from Within. S. A. Moseley, R.N.V.R. London: Sampson Low.

The Secret of the Navy: What it is and What we owe to it. B. Copplestone. London: Murray.

Indiscretions of the Naval Censor. Rear Adm. Sir Douglas Brownrigg, K.C.B. London: Cassell.

To Kiel in the "Hercules." L. R. Freeman. London: Murray.

Descriptive of experiences with Admiral Sir Montague Browning's squadron after the Armistice, to supervise the disarmament of the remaining German war vessels.

A Naval Lieutenant, 1914–1918. "Etienne." London: Methuen.

Gives eyewitnesses' details as seen by an officer in a light cruiser (H.M.S. Southampton) attached to the Grand Fleet and present at Heligoland Bight, the Dogger Bank, and Jutland, as well as details of the everyday work of a cruiser on general service in the North Sea between 1914 and 1917.

With the Grand Fleet. [From the Collection presented to the British Museum by H.M. Government.] Muirhead Bone. London: Offices of *Country Life*. [Portfolio: with six Pictures.]

The Triumph of the Royal Navy: How the German Fleet came to Britain. (Published with the authority of the Admiralty.) Major P. Gibbon, R.M. London: Hodder & Stoughton.

The Declaration of Paris. A Study: Documented. Sir Francis Piggott. University of London Press.

The Freedom of the Seas in War. Sir Francis Piggott. London: Clowes.

The Law of the Sea. A short History of some Questions relating to Neutral Merchant Shipping. G. W. T. Omond. London: A. & C. Black.

The Neutral Merchant in Relation to the Law of Contraband and Blockade. Sir Francis Piggott. London University Press.

The Law of Contraband of War. H. R. Pyke, LL.D. Oxford: Clarendon Press.

Armed Merchant Ships. A. Pearce Higgins, LL.D. London: Stephens & Stephens.

The Navy and Prize. Com. M. H. Anderson, R.N. Portsmouth: Gieve.

Lloyd's Reports of Prize Cases. Vols. I. to V. Lloyds.

Letters to the *Times* upon War and Neutrality. T. E. Holland. London: Longmans.

A Treatise on International Law. W. E. Hall. Edited by A Pearce Higgins, LL.D. Oxford: Clarendon Press.

Government and the War. Spencer Wilkinson. London: Constable.

British War Administration. J. A. Fairlie. Oxford University Press.

The Eastern Question. J. A. R. Marriott. Oxford: Clarendon Press.

The British Shipping Industry. E. Crammond. London: Constable.

The Naval and Military Geography of the British Empire (considered in relation to the War with Germany). Vaughan Cornish. London: H. Rees.

The Strategic Geography of the Great Powers. Vaughan Cornish. London: G. Philip.

Seaways of the Empire. Notes on the Geography of Transport. A. J. Sargent. London: A. & C. Black.

The Channel Tunnel and the Great War. London: Channel Tunnel Co.

The Freedom of the Seas. Gerard Fiennes, Sir F. Piggott, and J. Leyland; comments by Admiral Sir Edmond Slade. London: Society of Arts.

Direct and Indirect Costs of the Great World War. E. L. Bogart. Oxford University Press.

The Royal Navy List and Who's Who in the Navy. London: Witherby. (Last published in 1916.)

Brassey's Naval and Shipping Annual. London: Clowes.

Fighting Ships. F. T. Jane. London: Sampson Low. (Annual.)

The Log of H.M.S. Bristol, 1914–1915. William Buchan, Ld. Sig. Westminster Press. (Includes the Falklands Action.)

The Free Seas in War. Sir Francis Piggott. P. S. King & Son.

The Law of Naval Warfare. J. A. Hall, LL.B., Lieutenant, R.N.V.R. Chapman & Hall.

Experiences of a War Baby. By One. (Diary of a Midshipman and Acting Sub-Lieutenant in the Grand Fleet, including Jutland.) Gieve's Publishing Co.

The British Navy in War. L. G. Carr Laughton. Methuen.

Last Voyage of H.M. Hospital Ship Britannic. Rev. J. A. Fleming. Marshall Bros., Ltd.

The Last Cruise of the Majestic. George Goodchild. Simpkin Marshall.

Prisoners of the Red Desert: A History of the Men of H.M.S. Tara. Captain R. S. Gwatkin-Williams, C.M.G., R.N. Introduction by the Duke of Westminster. Thornton Butterworth, Ltd.

War in the Underseas. Harold F. B. Wheeler. G. G. Harrap & Co.

Under the Periscope. Lieutenant Mark Bennett, R.N.R. W. Collins Sons & Co., Ltd.

The Grand Fleet. H. C. Ferraby. Herbert Jenkins, Ltd.

The Imperial British Navy. H. C. Ferraby. Herbert Jenkins, Ltd.

The British Navy: The Navy Vigilant. L. Cope Cornford. Macmillan.

Tales of the Great War. Sir Henry Newbolt. Longmans, Green & Co.

Submarine and Anti-Submarine. Sir Henry Newbolt. Longmans, Green & Co.

Stories of the Ships. Lieutenant L. R. Freeman, R.N V.R. Murray,

"The Royal Mail" War Book. H. W. Leslie. William Heinemann.

Naval Guns in Flanders. "L.F.R."

"National Service" of British Merchant Seamen, 1914–1919. Father Hopkins, C.B.E., O.S.P. George Routledge & Sons.

Sea Fights of the Great War. W. L. Wyllie, R.A., & M. F. Wren, Cassell.

More Sea Fights of the Great War. W. L. Wyllie, R.A., C. Owen, and W. D. Kirkpatrick. Cassell.

Pushing Water. "R.N.V." (Describing service in Naval motor launches.) John Lane (Active Service Series).

The Navy and Sea Power. David Hannay. Williams & Norgate.

A Sea-Lawyer's Log. William Lang. Methuen.

The Handmaiden of the Navy. G. S. Doorly. Williams & Norgate.

Mystery Ships. Alfred Noyes. Hodder & Stoughton.

Open Boats. Alfred Noyes. Blackwood.

Sea Warfare. Rudyard Kipling. Macmillan.

The British Submarine in Being. J. A. Blackburn and Kenneth Watkins. Gieve's Publishing Co.

A Naval Digression. "G.F." (An account of war service in H.M.S. Invincible, up to her loss at Jutland.) Blackwood.

Under the guise of fiction, several officers of the Royal Navy have written sketches of the war, introducing facts and episodes from the North Sea and elsewhere. These include: "Taffrail" (Commander H. Taprell Dorling, D.S.O.); "Klaxon" (Commander John Graham Bower, D.S.O.); "Etienne" (Lieutenant W. S. R. King-Hall, R.N.); "Bartimeus" (Paymaster Lieutenant-Commander Lewis A. da Costa Ricci); "A Grand Fleet Chaplain" (Rev. Montague T. Hainsselin, B.A.).

[*Published in America.*]

Naval Power in the War. Lt.-Com. C. C. Gill, U.S.N. New York: Doran Co.

The Northern Barrage. Mine Force U.S. Atlantic Fleet. The North Sea. Annapolis: U.S. Naval Institute.

The Yankee Mining Squadron, or, Laying the North Sea Mine Barrage. Capt. R. R. Belknap, U.S.N. Annapolis: U.S. Naval Institute.

The Development of German Prize Law. C. H. Huberick and R. King. New York: Baker, Voorkis & Co.

A Survey of International Relations between the United States and Germany. J. Brown Scott. New York and Oxford University Press.

From Midshipman to Rear-Admiral. Rear-Admiral Bradley A. Fiske, U.S.N. London: T. Werner Laurie, Ltd. (Chapters on American Naval Administration during the war, and the author's participation while in office.)

America's Merchant Marine. New York: Bankers' Trust Company.

[*Published in France.*]

La Marine Française pendant la Grande Guerre 1914–1918. G. Clerc-Rampal. Paris: Larousse.

La Guerre Navale. Mer du Nord—Mers Lointaines. F. Hubert. Paris: Payot.

Sur nos Fronts de Mer. Com. E. Vedel. Paris: Plon-Nourrit.

Deux Années de Guerre Navale. R. La Bruyère. Paris: Chapelot.

Les Enseignements Maritimes de la Guerre anti-Germanique. Contre-Am. Daveluy. Paris: Challemel.

La Guerre Navale et l'Offensive. Amiral Degouy. Paris: Chapelot.

L'Action des Alliés sur les Mers. A. Rousseau. Paris: Société Française d'Imprimerie.

Nos Marins de la Guerre (Sur Mer et sur Terre). Com. E. Vedel. Paris: Payot.

Nos Marins en Guerre. Capit. Bornecque et Lieut. Drouilly. Paris: Berger-Levrault.

Les Patrouilleurs de la Mer. M. Nadaud. Paris: Albin Michel.

Quatre Années de Guerre Sous-marine. Com. E. Vedel. Paris: Plon-Nourrit.

Sous-Marins et Blocus. A. Rousseau. Paris: Félix Alcan.

Les Sous-Marins. G. Clerc-Rampal. Paris: Plon-Nourrit.

Souvenirs de Chasse aux Sous-Marins Allemands. F. Darde. Paris: Perrin.

La Bataille Navale de Jutland. O. Guehéneuc. Paris: Perrin.

La Bataille Navale de Jutland. Capt. H. de Parseval. Paris: Payot.

La Bataille Navale du Skagerrack. Capit. Poildoue. Paris: Editions et Librairie.

La Bataille de Jutland vue du Derfflinger (Les deux peuples blancs). Translated from the German by Delage. Paris: Payot.

L'Expédition des Dardanelles. C. Stiénon. Paris: Chapelot.

La Campagne des Dardanelles. X. Toran-Bayle. Paris: Editions et Librairie.

Décisions du Conseil des Prises et Décrets rendus en Conseil d'Etat en Matière de Prises Maritimes. Paris: Challemel.

La Guerre Sous-Marine et L'Espagne. F. Vézinet. Lyon: Lardauchet.

Les Vagabonds de la Gloire. R. Milan. Paris: Plon-Nourrit.

Marine et Guerre Navale. Capitaine de Frégate J. Vaschalde. Paris: Masson et Cie.

[*Published in Norway, Holland, and Italy.*]

Rapports de Mer sur les Pertes de Guerre subies par la Marine de Commerce Norvégienne. Christiania: L'Inspecteur Général de la Navigation.

Grotius: Annuaire International. La Haye: M. Nyhoff.

L'Insidia Sottomarina e come fu debellata. Contrammiraglio E. Bravetta. Milan: Hoepli.

Gli avvenimenti navali nel conflitto Europeo. R. Massinghi. Rome: *Rivista Marittima.*

[*Published in Germany.*]

Aus Aufzeichnungen und Briefen während der Kriegzeit. Adm. Hugo von Pohl. Berlin: Siegismund.

This is one of the most important and instructive books on the war from the German side. It is the intimate and confidential narrative concerning the conditions and state of affairs existing in the High Seas Fleet during the first part of the war. Admiral von Pohl practically worried himself to death (in Jan., 1916) over the anxieties of his post. Much of his trouble was due to interference by the Kaiser and War Cabinet. He discloses a good deal with regard to the defects of the ships under his command, and unsuspected deficiencies in German dockyard administration. The book is issued by his widow in defence of her husband's memory. Owing unfortunately to copyright difficulties raised by the German publishers no translation in English has yet appeared.

Der Krieg zur See 1914–1918. Vol. I.: Krieg in der Nordsee. Com. O. Groos. Berlin: Mittler.

Commander Otto Groos has had access to a number of German official records and has been assisted with information supplied by German officers. His work deserves attention, and is in the main authentic in its statements.

Das Admiralstabswerk über den Krieg zur See, 1914. Vol. I.: Der Krieg in der Nordsee—August 1914. Berlin: Mittler.

Die Zwei Weissen Völker. Com. G. von Hase. Leipsic: Koehler.

Von Hase's work is interesting and reliable. It gives a German account of Jutland from a gunnery officer's point of view. Von Hase was gunnery officer of the Derfflinger.

Der Einfluss der Seemacht im Grossen Krieg. Count Reventlow. Berlin: Mittler.

Count Reventlow, a retired naval officer, has long been prominent as a critic and usually well-informed writer on German naval affairs. Much of the information on which his work is based is drawn from semi-official and confidential sources.

Unser Krieg. Capt. L. Persius. Münich: Der Gelbe Verlag.

Der Seekrieg. Capt. L. Persius. Charlottenburg: Verlag der Weltbühne.

Der Seekrieg 1914–1915. Vice-Adm. H. Kirchoff. Leipsic: Hesse und Becker.

Unsere Flotte im Weltkriege. Rr.-Adm. Kalau von Hofe. Berlin: Mittler.

Die Aufgaben der Deutschen Flotte im Weltkriege. Rr.-Adm. K. Hollweg. Berlin: Ullstein.

Weltkrieg und Flotte. Capt. von Bogislaw. Berlin: Siegismund.

Die Deutsche Kriegsflotte und ihre Verbündeten. 4 vols., 1914–1918. Dr. S. T. Mittler. Berlin: Mittler.

Erinnerungen. Gr. Adm. Tirpitz. Leipsic: Koehler.

Tirpitz der Totengräber der deutschen Flotte. Capt. L. Persius. Berlin: Koch und Jurgens.

Captain Persius' book should be read in connection with the Memoirs of Grand Admiral Tirpitz, the English translation of which is referred to earlier in these notes. The writer is notorious as a bitterly hostile critic of the Tirpitz administration and his enmity with the admiral is of long standing.

Die Seeschlacht vor dem Skagerrak. H. E. Schlüter. Leipsic: Hesse.

Skagerrak. Der Ruhmestag der Deutsche Flotte. Capt. von ⁂ Berlin: Ullstein.

Die Seeschlacht vor dem Skagerrak. Capt. Scheibe. Berlin: Mittler.

Die Fahrten der "Goeben" und der "Breslau." E. Ludwig. Berlin: Fischer.

Die Fahrten der "Goeben" in Mittelmeer. Lieut. Kraus. Berlin: Ullstein.

Die Fahrten der "Breslau" in Schwarzen Meer. Lieut. Donitz. Berlin: Ullstein.

Die Kriegsfahrten S.M.S. "Karlsruhe." Capt.-Lieut. Aust. Karlsruhe: G. Braun.

S.M.S. "Karlsruhe," Eines Deutschen Kreuzer's Glück und Ende. Leipsic: T. Weicher.

Kreuzerfahrten und Kriegserlebnisse S.M.S. "Dresden." Capt. Lüdecker. Berlin. Marinedank-Schröder.

"Emden." Capt. H. von Mücke. Berlin: Scherl.

"Ayesha." Capt. H. von Mücke. Berlin: Scherl.

Capt. (then Lieut.) von Mücke was the officer of the Emden landed at Cocos Island, who escaped in the commandeered Ayesha, and with his party eventually reached Germany.

Die Fahrten der "Emden" und der "Ayesha." E. Ludwig. Berlin: Fischer.

Auf der "Emden" und "Ayesha." H. Oesterwitz. Berlin: Wallmann.

S.M.S. Möwe. Capt. Count Dohna-Schlodien. Gotha: Perthes.

Captain Count Dohna-Schlodien was the commander of the German commerce raider Möwe. His narrative of his cruises may be accounted as a fair and presumably accurate statement of facts, and the record of a skilfully conducted enterprise.

Der Möwe. Zweite Fahrt. Capt. Count Dohna-Schlodien. Gotha: Perthes.

Blockade-Brecher. K. E. Serman-Selow. Berlin: Scherl.

S.M.S. "Wolf." Com. Nerger. Berlin: Scherl.

Im Torpedoboot gegen England. F. Graf. Berlin: Scherl.

Kreuzerfahrten und U-bootsfahrten. O. von Gottberg. Berlin: Ullstein.

U-39 auf Jagd im Mittelmeer. Capt. W. Forstmann. Berlin: Ullstein.

Das U-boot bei der Arbeit. J. Kirchner. Berlin: Mittler.

Die Deutschen U-Boote in ihrer Kriegführung 1914–1918. Capt. A. Gayen. Berlin: Mittler.

Als U-Boots Kommandant gegen England. Capt. G. G. von Forstner. Berlin: Ullstein.

U-202 Kriegstagebuch. Freiherr Spiegel von und zu Peckelsheim. Berlin: Scherl.

Unser Recht auf den U-bootskrieg. Rr.-Adm. K. Hollweg. Berlin: Ullstein.

Flemmings Karte der Schiffversenkungen unserer U-Booten nach Lage und Zahl dargestellt auf Grund amtlichen Materiels. Dr. J. J. Kettler. Berlin: Flemming.

Handels U-boot "Deutschlands" Fahrt nach Amerika. E. Lassen. Leipsic: Montanus.

Die Fahrt der "Deutschland." Capt. P. König. Berlin: Ullstein.

As noted at the end of the list of "Books published in Great Britain," a large number of small books of a semi-fictional character have been published in Germany, but they are of little or no historical value. A few of the same kind have also been published in France.

EDWARD FRASER.

CHAPTER XI.

THE EX-ENEMY FLEETS.

IT was not until the end of September that all the vessels of the German and Austrian navies surrendered under the Peace Treaties and the various Protocols were available for distribution among the Allied and Associated Powers appointed to receive them. In the statements which follow the final destination of each vessel is set forth. For the purposes of comparison, the following tabular summary will be found useful:—

	Sunk at Scapa.	Great Britain.	France.	Italy.	Japan.	U.S.A.	Minor Powers.	Total.
German battleships .	10	5	1	—	2	1	—	19
Austrian battleships .	—	6	3	4	—	—	—	13
Austrian cruisers . .	—	2	—	—	—	—	—	2
German battle-cruisers	5	—	—	—	—	—	—	5
German light cruisers .	5	6	5	3	1	1	—	21
Austrian light cruisers	—	6	1	2	—	—	—	9
German leaders and destroyers . . .	—	39	12	3	4	3	—	61
Austrian destroyers .	—	—	3	15	—	—	1	19
German torpedo boats	—	38	—	—	—	—	12	50
Austrian torpedo boats	—	13	4	7	—	—	31	55
Austrian mining craft, etc.	—	2	3	9	—	—	—	14

EX-GERMAN FLEET.

Battleships.

Name.	Date of Launch.	Displacement, tons.	Speed, knots.	Heaviest Guns.	How disposed of.
Baden	1915	28,000	22	8 15″	G.B., salved at Scapa and broken up.
Bayern	1915	28,000	22	8 15″	Sunk at Scapa.
Grosser Kurfürst . .	1913	25,390	21	10 12″	,, ,,
König	1913	25,390	21	10 12″	,, ,,
Kronprinz Wilhelm .	1914	25,390	22	10 12″	,, ,,
Markgraf	1913	25,390	22	10 12″	,, ,,
Friedrich der Grosse .	1911	24,310	21	10 12″	,, ,,
Kaiser	1912	24,310	22	10 12″	,, ,,
Kaiserin	1911	24,310	22	10 12″	,, ,,
König Albert . . .	1912	24,310	22	10 12″	,, ,,
Prinzregent Luitpold .	1912	24,310	21	10 12″	,, ,,
Helgoland	1909	22,440	20·5	12 12″	G.B., broken up.
Ostfriesland. . . .	1909	22,440	21	12 12″	U.S.A., broken up, New York.
Thüringen	1909	22,440	21	12 12″	Fr., broken up, Brest.
Oldenburg	1910	22,440	21	12 12″	Japan, broken up, Holland.
Nassau	1908	18,600	20	12 11″	Japan, broken up in U.K.
Westfalen	1908	18,600	20	12 11″	G.B., broken up.
Rheinland	1908	18,600	20	12 11″	G.B., broken up, Holland.
Posen	1908	18,600	20	12 11″	G.B., broken up.

Battle-Cruisers.

Name.	Date of Launch.	Displacement, tons.	Speed, knots.	Heaviest Guns.	How disposed of.
Hindenburg	1915	26,200	28	8 12″	Sunk at Scapa.
Derfflinger	1913	26,180	27	8 12″	„ „
Seydlitz	1912	24,610	29	10 11″	„ „
Moltke	1910	22,640	28	10 11″	„ „
Von der Tann	1909	19,100	27·5	8 11″	„ „

Light Cruisers.

Nürnberg	1916	4,200	28·5	7 5·9″	G.B., broken up.
Emden	1916	4,200	28·5	7 5·9″	Fr., broken up.
Karlsruhe	1916	4,200	28·5	7 5·9″	Sunk at Scapa.
Dresden	1916	4,200	28·5	7 5·9″	„ „
Frankfurt	1915	5,120	28	8 5·9″	U.S.A., broken up.
Bremse	1915	4,000	34	4 5·9″	Sunk at Scapa.
Brummer	1915	4,000	34	4 5·9″	„ „
Köln	1916	4,200	28·5	7 5·9″	„ „
Könisberg (now Metz)	1915	4,200	28·5	7 5·9″	Fr., incorporated.
Pillau	1914	4,320	27·5	8 5·9″	It., incorporated.
Graudenz (now Ancona)	1913	4,842	27·5	7 5·9″	„ „
Regensburg (now Strasbourg)	1914	4,842	27·5	7 5·9″	Fr., incorporated.
Stralsund (now Mulhouse)	1912	4,480	28	7 5·9″	„ „
Strassburg	1912	4,480	28	7 5·9″	It., incorporated.
Augsburg	1909	4,280	27	6 5·9″	Jap., broken up.
Kolberg (now Colmar)	1908	4,280	26·5	6 5·9″	Fr., incorporated.
Stettin	1907	3,494	25·5	10 4·1″	G.B., broken up.
Stuttgart	1906	3,400	23·5	10 4·1″	„ „
Danzig	1905	3,200	23	10 4·1″	„ „
München	1904	3,200	23·5	10 4·1″	„ „
Lübeck	1904	3,200	23	10 4·1″	„ „

EX-AUSTRIAN FLEET.

Battleships.

Prinz Eugen	1915	20,000	20·5	12 12″	Fr., broken up.
Tegetthoff	1912	20,000	20·5	12 12″	It., broken up.
Zrinyi	1910	14,226	20·5	4 12″	„ „
Radetzky	1909	14,226	20·5	4 12″	„ „
Erz. Franz Ferdinand	1908	14,226	20·5	4 12″	„ „
Erz. Ferdinand Max	1905	10,433	20	4 9·4″	G.B., broken up.
Erz. Friedrich	1904	10,433	20·5	4 9·4″	Fr., broken up.
Erz. Karl	1903	10,433	20	4 9·4″	„ „
Arpad	1901	8,208	19·5	3 9·4″	G.B., broken up.
Babenberg	1902	8,208	19·5	3 9·4″	„ „
Habsburg	1900	8,208	19·5	3 9·4″	„ „
Budapest	1896	5,462	17·8	4 9·4″	„ „
Monarch	1895	5,550	17·4	4 9·4″	„ „

Cruisers.

Sankt Georg	1903	7,185	22	2 9·4″	„ „
Kaiser Karl VI.	1898	6,151	19·5	2 9·4″	„ „

Light Cruisers.

Helgoland	1912	3,500	27	9 3·9″	It., incorporated.
Novara (now Thionville)	1913	3,500	27	9 3·9″	Fr., incorporated.
Saida	1912	3,500	27	9 3·9″	It., incorporated.
Admiral Spaun	1909	3,500	26	7 3·9″	G.B., broken up.
Szigètvár	1899	2,313	20	8 4·7″	„ „
Aspern	1899	2,362	20	8 4·7″	„ „
Maria Theresia	1893	5,270	19	2 7·5″	„ „
Panther	1885	1,530	18	4 11-pdr.	„ „
Leopard	1885	1,530	18	4 11-pdr.	„ „

Apart from those which were sunk at Scapa Flow in June, 1919, 2 German flotilla leaders, 59 destroyers, and 50 torpedo boats were surrendered to the Allies and have been disposed of. The flotilla leaders were V. 116, which was incorporated into the Italian Navy, as the Premuda, and S. 113, surrendered to France, for incorporation. Of the destroyers 39 went to Great Britain, 11 to France, 4 to Japan, 2 to Italy, and 3 to the United States. The distribution was as follows, the letters "BR." signifying the vessels which were broken up, and "IN." those which were incorporated into the Allied navies: To Great Britain, 39:—S. 137 (BR.), V. 128 (BR.), V. 125 (BR.), B. 98 (wrecked), G. 95 (BR.), G. 92 (BR.), V. 82 (BR.), V. 81 (foundered), V. 73 (BR.), V. 71 (BR.), S. 54 (foundered), S. 51 (foundered), V. 44 (BR.), V. 28 (BR.), V. 26 (BR.), S. 24 (BR.), T. 197 (BR.), T. 195 (BR.), T. 193 (BR.), T. 192 (BR.), T. 189 (BR.), T. 186 (BR.), T. 184 (BR.), T. 183 (BR.), T. 182 (BR.), T. 180 (BR.), T. 179 (BR.), T. 178 (BR.), T. 176 (BR.), T. 174 (BR.), T. 173 (BR.), T. 169 (BR.), T. 166 (BR.), T. 165 (BR.), T. 164 (BR.), T. 163 (BR.), T. 161 (BR.), T. 160 (BR.), and T. 159 (BR.). To France, 11:—H. 147 (IN.), H. 146 (IN.), S. 139 (IN.), S. 135 (IN.), S. 134 (IN.), S. 133 (IN.), V. 130 (IN.), V. 126 (BR.), V. 100 (BR.), V. 79 (IN.), V. 46 (BR.). To Japan, 4:—V. 127 (BR.), V. 80 (BR.), S. 60 (BR.), and T. 181 (BR.). To Italy, 2:—B. 97 (IN.), S. 63 (IN.). To United States, 3:—S. 132 (BR. at New York), G. 102 (BR. at New York), and V. 43 (BR. at New York).

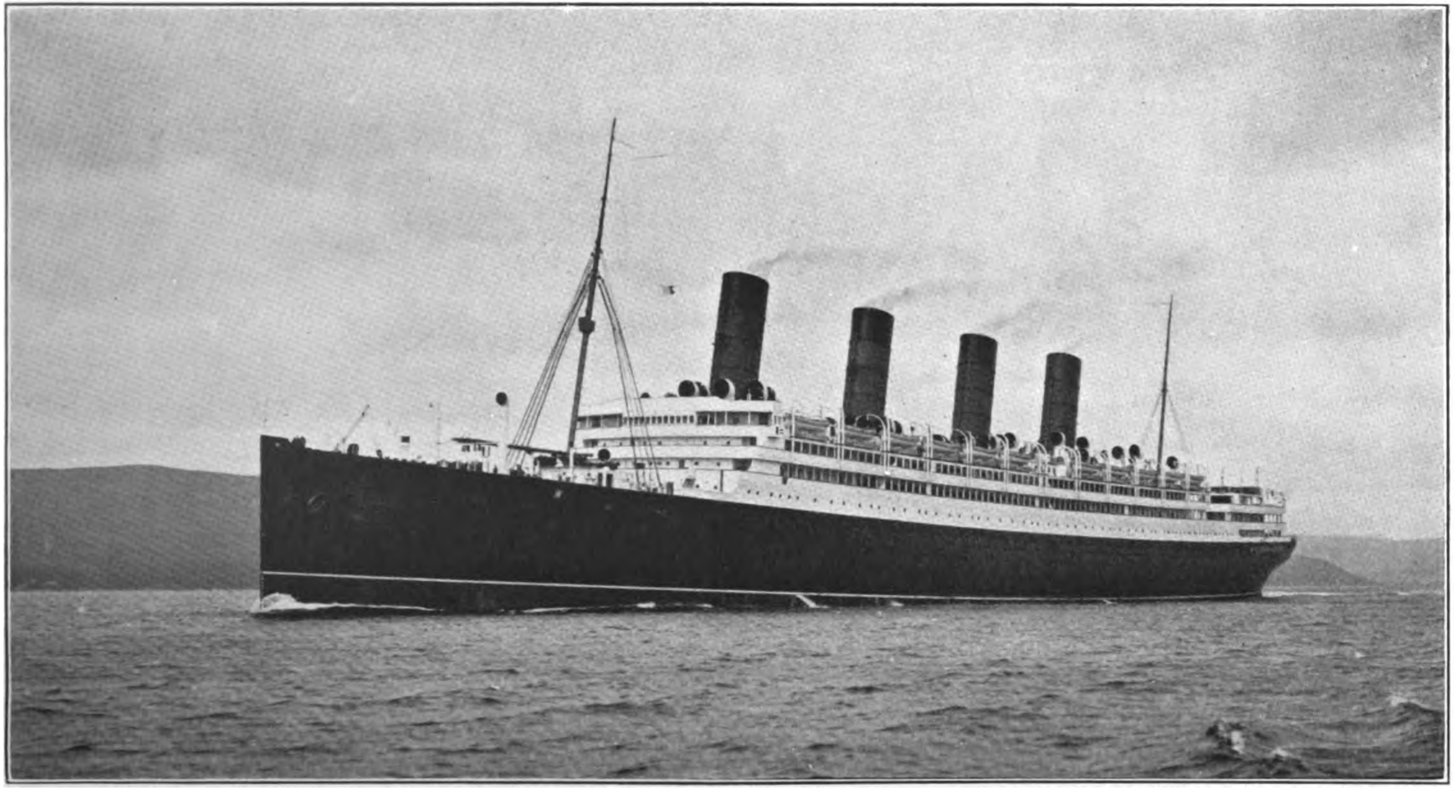
Of the 50 torpedo boats, all were surrendered to Great Britain, and 38 were to be broken up. Of the other 12, after they had been disarmed, six were to be selected by Poland and six by Brazil, the vessels to be used for police purposes. There was also surrendered the German auxiliary ship and salvage vessel Cyklops, which was broken up by Great Britain. The torpedo boats were in three groups. First, there were V. 108, 106, and 105, and A. 78, 74, 69, 68, 65, 48, 46, 45, 41, 39, 36, 35, 31, 29, 28, and 27. Next there were A. 92, 87, 62, 61, 53, 49, 44, 38, 37, 34, and 33. In the third group were A. 95, 94, 93, 91, 90, 89, 85,.86, 81, 80, 76, 75, 70, 66, 64, 63, 59, 55, 54, and 52.

The torpedo craft of the late Austrian Navy surrendered for disposal numbered 19 destroyers, 55 torpedo boats, 10 torpedo gunboats, and 4 mining vessels. Of the destroyers, 15 went to Italy, 7 for incorporation, the Lika, Uszok, Friglav, Orjen, Csepel, Balaton, and Tatra, and 8 for breaking up, the Varasdiner, Huszar, Dinara, Velebit, Czikos, Turnl, Uskoke, and Scharfschütze. France took for incorporation the Dukla, and for breaking up the Pandur and Reka. The remaining vessel, the Ulau, went to Greece for incorporation.

Of the torpedo boats, 13 were allocated to Great Britain, 12 to the Serbs, Croats, and Slovenes, 7 to Roumania, 6 to Greece, 7 to Italy, and 6 to Portugal, with 4 to France. The British boats, all for breaking up, were Nos. 8, 9, 10, 14, and 18; 50E, 51T, 53T, 55T, 56T, 57T, 58T, and 59T. The 12 to Yugo-Slavia were all for police duties, and consisted of Nos. 87F, 93F, 96F, 97F, 76T, 77T, 78T, 79T, 69F, 54T, and 60T and 61T. The boats for Roumania and Greece were likewise to be used on police duties; Roumania took 82F, 83F, 84F, 74T, 75T, 80T, and 81T; and Greece 98M, 99M, 100M, 92F, 94F, and 95F. The 7 Italian boats, all for breaking up, were 52T, and Nos. 1, 2, 4, 5, 6, and 12. Portugal will use her 6 boats on police duties; they are 85F, 86F, 88F, 89F, 90F, and 91F. France will break up the 4 allotted to her, Nos. 13, 15, 16, and 17.

Of the torpedo gunboats, the Satellit went to France, and the Magnet, Trabant, Planet, Komet, Blitz, Meteor, Sebenico, Spalato, and Zara to Italy—all for breaking up. The mining vessels Chamäleon and Salamander were to be broken up by Great Britain, and the Basilisk and Dromedar by France. Ten of the German submarines have been incorporated in the French Navy.

MERCHANT SHIPPING SECTION.



THE CUNARD LINER AQUITANIA.

Built and engined by Messrs. John Brown & Co., Ltd., Clydebank, N.B.

(*For particulars see p.* 329.)

FOREWORD.

CONTROL AND DE-CONTROL OF SHIPPING.

IN this issue of "Brassey's Naval and Shipping Annual," which maintains the honourable association of the Royal Navy with the Mercantile Marine, it is perhaps appropriate that the Shipping Controller should write a "Foreword" to the new Shipping Section. The Annual is entering on a fresh stage in its long and useful career. Mr. Archibald Hurd is one of the few publicists who have realised the vital importance of a strong Mercantile Marine to this island country; and it is a fortunate circumstance that he should be combining with Mr. Alexander Richardson, M.P., for so many years connected with "Engineering," in an effort to provide the standard handbook on sea power in its various aspects.

There are many subjects on which the Shipping Controller, after passing through the ordeal of war, might possibly write, but none is likely to prove more profitable than that which Mr. Archibald Hurd has suggested: Why control of shipping was necessary during the War, and why it must be removed now that peace has come.

When the War began, British shipping was working under a régime of practically complete freedom, for, subject to the regulations laid down in the Merchant Shipping Acts, owners could run ships in any trades and in any manner which they desired, and could buy and sell shipping property without any real restriction. By the time we were half-way through the War a considerable percentage of British ships had been requisitioned by the Government; no ships could start on any voyage or carry any cargo without a Government licence; and no one could buy, sell, or charter a ship without Government permission. As time went on the control was as close as anything short of complete expropriation could make it, yet it was recognised as necessary by the great body of those whose property was thus controlled, and shipowners were among the most loyal servants of the Government in carrying out the work of shipping control.

Control was necessary because these islands depended on merchant tonnage for the successful prosecution of the War, and, while the supply of that tonnage was continually dwindling, the demands made on it for the maintenance of the fighting forces of the Allies and the civil population were continually increasing.

It was only by degrees that control was made complete. The first stage was the requisition of a relatively small number of ships for purely naval and military purposes, for the service of our own forces and those of the Allies. It was necessary to requisition (as distinct from voluntary charter), because in no other way could the Government ensure being able to obtain instantly the several hundred suitable ships essential for the conduct of naval and military operations whose success depended upon instantaneous action. The great bulk of the merchant fleet continued trading as usual, subject only to such restrictions as were imposed for safety purposes by the Admiralty. The Dardanelles and other overseas expeditions, and the vast increase in the amount of munitions and warlike stores of all kinds, caused more and more ships to be requisitioned.

The second stage was control for the transport of foodstuffs. The first sugar ship was requisitioned in March, 1915, and the insulated spaces on all meat ships were requisitioned in April, 1915. In November, 1915, power was taken to requisition for the carriage of wheat and similar foodstuffs, and many vessels were required to load a certain percentage of their space with these commodities. The process was a gradual one, because the truth was realised from the outset that the public would gain no benefit whatever from cheap freight unless the goods themselves were controlled, and it was only by degrees that complete Government control of foodstuffs was established.

The process in the case of shipping was the same as in the case of trade and of the other activities of the nation—the War dominated everything, and all energy had to be concentrated on the two purposes of keeping the fighting forces supplied and keeping the nation going. The licensing of ships introduced in November, 1915, was a step in this direction; every ship had to obtain a licence before proceeding on any voyage, and thus all movements of British ships were brought under control. The transfer of ships to foreign flags was forbidden by an Act passed earlier in the same year, March, 1915. As the War went on, more and more ships were required for naval and military transport and for the shipment of cargoes owned or controlled by the Government, and the control of shipping by means of requisition, direction, and the licensing system became closer and closer. The establishment of the Ministry of Shipping in December, 1916, and the subsequent requisitioning of all but a very small minority of the tonnage of the country, were simply the last steps in the process.

The step was inevitable. The great bulk of the cargoes carried were either Government owned or for Government account: munitions and material of all kinds for carrying on the War, iron ore, timber, sugar, grain, meat and foodstuffs for the armies, the Allies, and the civil population. It was essential that all British ships, and the great and growing number of neutral ships under Allied control, should be used as one big fleet for one common purpose, and the simplest and most economical method of doing this was to establish a special office for the purpose.

The one thing needed was that this control should be exercised by men experienced in ship management. It is worthy of record that the nation had throughout the War the willing and unpaid services of many of the ablest men in the shipping industry: first as advisers to the Transport Department, or as members of the

Licensing, Shipping Control, and other special shipping committees; then, after the establishment of the Ministry of Shipping, as heads of its branches and advisers in the Ministry itself. The work could not have been successful without the wholehearted co-operation of shipowners, both inside and outside the Ministry.

The necessity for Government control during the War, then, was due to two main factors (apart from that of safety): the need for obtaining ships instantly for belligerent services, whose success depended upon immediate action; and the need for centralising management so as to conform with Governmental policy regarding essential imports at a time of emergency, when the supply of shipping, depleted by losses and belligerent demands, could not fulfil the commercial demands of the public.

With the close of warlike operations and the repatriation of overseas troops, etc., the first of these factors disappeared. The release of merchant ships from belligerent service, combined with the building of new ships to replace losses, has gradually readjusted the balance of commercial supply and demand, and removed the second factor which called into being the Government control of commercial services.

The best system of Government control must be wasteful, because its essence and object are the diversion of trade and energy from their natural channels. It was evident that as soon as tonnage ceased to be the limiting factor in the movement of commodities, control must be relaxed. The process had to be gradual, in order to avoid violent change and dislocation; neutral ships were re-delivered to their owners, and British ships were released from requisition, but remained subject to licence and direction, which was maintained until the fall in freights rendered even this class of control a mere formality.

Control could not have been prolonged without destroying the mercantile marine as we know it, just as it could not have worked at all if it had not had a magnificent fleet built up by private enterprise, and a number of skilled and experienced men who had learned their business in private trading.

The *raison d'être* of the business man is to anticipate, and supply directly, the wants of the public; the *raison d'être* of the official is to obey orders, which are given by politicians, and may or may not correspond with what the public wants to buy and sell.

To adopt as a permanent institution the emergency system, which was forced upon us by the exigencies of war, would be a foolish experiment, ignoring the facts of history and of human nature. The experience of the War itself in all its departments has shown how hazardous that experiment would be.

British shipping, crippled by the War much more than most people realise, is faced now by stronger competitors than it has ever had to meet before; but there is plenty of life in it still, and as long as it is treated as a living and growing organism, and allowed to expand and develop naturally, it will work out its own salvation.

J. P. MACLAY.

CHAPTER I.

THE MERCHANT NAVY IN THE WAR.

It is fitting that the first issue of this publication after the conclusion of Peace should draw attention to the magnificent services rendered to the Empire and to the whole Allied cause during the Great War by the British Mercantile Marine. For the founder of the "Naval Annual," the first Earl Brassey, throughout his life, consistently urged the value of that great service in war time, and frequently brought forward proposals for the provision of measures which would render the large ships of the Merchant Service of use to the Navy during hostilities. He was also greatly interested in the future of the Royal Naval Reserve, and was himself an officer of that Service. He had served at the Admiralty as Civil Lord in 1880–83, and as Financial Secretary in 1883–85. As a yachtsman who loved the sea, he never lost his interest in the Royal Navy and the Mercantile Marine, and in this publication bearing his name he has left what should prove an enduring memorial. It is, therefore, impossible to write in what will in future be known as "Brassey's Naval and Shipping Annual" of the deeds of the Mercantile Marine without paying a passing tribute to Lord Brassey's foresight and patriotism.

On the outbreak of war, in August, 1914, the two great sea services of the Empire, the Royal Navy and the Mercantile Marine, were associated in various directions, and the latter force was equipped, in some degree, to assist the former in its task of guarding our sea communications. Gun armaments had been provided at various ports, at home and abroad, which were intended to be utilised, and which were utilised, in arming a certain number of our best liners with a view to their use as auxiliary cruisers. Some of these ships had been prepared for the reception of these armaments. It is noteworthy that one such ship, the Teutonic, was present at the Naval Review at Spithead in honour of the ex-Kaiser as long ago as 1889, with her armament on board. The writer was deputed to explain the details of the armament to the ex-Kaiser on this occasion. Shortly before the outbreak of war, persistent reports of the intention of the Germans to arm their large merchant ships on the high seas, or in port, with guns carried in some cases in their holds, with a view to depredations on our commerce on the outbreak of war, had led the Board of Admiralty, presided over by Mr. Churchill, to press some of our leading shipowners to prepare their ships to receive a *defensive armament* of one or two guns mounted in the stern of the ships. Rear-Admiral H. H. Campbell, C.V.O., assisted by Fleet Paymaster H. H. Share,* was entrusted with the duty of taking up the question with the shipping lines. With characteristic patriotism a considerable response to this appeal was made by many leading shipowners, and a number of ships had been fitted to receive defensive armaments before the outbreak of war. In other directions, such as training officers and men in signal work, the shipowners had also co-operated with the Admiralty in pre-war days.

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* Now Paymaster Captain Sir Hamnet Share.

Another important step taken, a year or two preceding the war, had been the formation of a *Trawler Reserve of Mine-sweeping Vessels.* These craft were manned by fishermen who were trained in mine-sweeping duties and received a small retaining fee for training in peace and their services in war. They were the nucleus of the invaluable mine-sweeping service which was developed in later years to meet a great emergency.

Finally, the two sea services were connected by the Royal Naval Reserve, composed of officers and men of the Mercantile Marine, who underwent systematic training in gunnery and other work; a proportion of the officers and men of this valuable reserve also served afloat on board men-of-war, both during manœuvres and at other times.

Armed Merchant Cruisers.

The connection between the two services became much closer immediately on the outbreak of war and was strengthened as the struggle progressed, to the mutual advantage of both services; the officers and men came to know each other as they had never done before, and the comradeship thus established was of exceeding value to the Empire. It should never be allowed to diminish in cordiality and *esprit de corps.*

The earliest steps taken were to arm such merchant ships as were fitted for armaments, to commission them under the White Ensign for service as auxiliary cruisers, and to attach them to our outlying squadrons. It was seen very soon that the old cruisers* comprising the 10th, or Blockading, Cruiser Squadron in the northern approaches to the North Sea were unserviceable through age, and they were replaced by twenty-four armed merchant ships manned very largely by mercantile crews. These vessels carried out work of inestimable value to the Allied cause under the most difficult and arduous conditions, and they suffered heavy losses from submarine and mine attack in the course of the struggle. More than one ship was lost with all hands by foundering as a result of the heavy weather constantly experienced in the high northern latitudes in which they worked. The total losses of this squadron during the war were very heavy and included the auxiliary cruiser the Alcantara, sunk by torpedo during her spirited action with the German raider Grief, which resulted in the sinking of the latter vessel by gun-fire with much loss of life. No account of the work of our auxiliary cruisers would be complete without mention of the fine work of the Carmania which engaged and sank the German auxiliary cruiser Cap Trafalgar soon after the commencement of the war. As soon as the enemy began his submarine campaign against merchant shipping, a great extension of the system of defensive armaments in these vessels became imperative, as a gun armament, if sufficiently powerful, was adequate protection for vessels against attack by submarines, so long as the attack was delivered by means of gun-fire.

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* These were vessels of the Edgar class of 7350 tons, mounting two 9·2-in. and ten 6-in. guns. Originally they possessed speeds of about 19 knots. They were built under the Naval Defence Act of 1889.

There was, however, great difficulty in the provision of the necessary guns for our ships, since the resources of the country were fully occupied with the manufacture of the immense quantity of artillery needed for our rapidly expanding armies. The result was that up to the end of 1916 only 1420 ships had been armed, and even then many of the guns supplied were of too small a calibre and too short a range to enable them to cope with the heavier armaments of the German submarines. The process of providing armaments was very considerably hastened during 1917, and by the end of that year 4407 ships had been armed. There was a further increase during 1918, but during the two latter years unrestricted submarine warfare had been introduced and attack by torpedo was far more frequent. Against this form of attack, the gun armament could of necessity not play a very prominent part.

Another important and most necessary step taken in the early days of the war was the provision of a large force of yachts and trawlers for patrol and mine-sweeping work. The demands for this class of vessel were never-ending. By the end of the year 1914, there were 700 auxiliary vessels on service, and by the end of 1917 the number had increased to 3084, of which 473 were in the Mediterranean. The trawlers and drifters were largely manned by fishermen, and were divided into units of six, which were commanded by officers of the R.N. or R.N.R. The work which they performed will form one of the most stirring aspects of the history of the naval side of the war. The loss of life, up to the end of the year 1917, in this service amounted to 197 officers and 1782 men, which conveys some conception of the hardihood, courage, and dogged persistence of these fine seamen.

MINE-LAYERS: THE BLOCKADE.

The outbreak of war found the Navy with a small force of old cruisers equipped as mine-laying vessels. It became necessary to increase this force, and some six or seven fast merchant ships were taken up and converted into mine-layers. During the war they were constantly at work laying mines either offensively in enemy waters in the North Sea and Mediterranean, or defensively in our own waters. Their immunity from loss by enemy action was extraordinary when the hazardous nature of their work in waters near the enemies' bases is considered. The principal losses sustained were the destruction of the mine-layer Princess Irene with all hands in the Medway on May 27, 1915, by the explosion of her own mines from some unascertained cause, and the sinking of the Ariadne by a submarine in the English Channel on July 26, 1917.

The risks run by large vessels in the North Sea of being sunk by submarine attack whilst they were stopped for the purpose of lowering or hoisting boats which were used for boarding strange vessels, led to a number of cross-channel steamers being taken up by the Admiralty and used in conjunction with the larger ships for this purpose. They were termed Armed Boarding Steamers and carried out much useful work in this and other directions, notably in the later years of the war in the transport of troops between Taranto and Salonika. One of these vessels, the Dundee, under the command of Captain Selwyn Day, R.N.R., and manned to a great extent by merchant seamen, was largely instrumental in sinking by gun-fire, north of the Shetland Islands, a German raider, the ex-British ship Yarrowdale, in 1917. The Dundee was working at the time in co-operation with H.M.S. Achilles.

Another lightly-armed boarding steamer, the Ramsey, was sunk by the disguised German mine-layer, Meteor, at the entrance to Cromarty Firth in 1916. The Meteor carried a far superior gun armament, and, being disguised as a neutral merchant ship, caught the Ramsey at a great disadvantage. The Meteor was intercepted on her return by the Harwich Forces off the Horn Reef, and was sunk by her crew to avoid capture. Yet another armed boarding steamer was sunk by a German submarine whilst on patrol duty to the south-eastward of the Pentland Firth.

Very early in the war the Admiralty took over a large number of our passenger liners for conversion into hospital ships for the use of the fleet and of the army. Under ordinary circumstances of civilised warfare these vessels would have been immune from attack by the enemy, but, as is well known, the Germans made these the object of attack in the later stages of the war, exposing the merchant crews to risks which were never contemplated in surveying the possibilities of war, and resulting in great loss of life. Our overseas Dominions co-operated in the work by providing hospital ships for their Expeditionary forces, and one such vessel was fitted out by the Indian Native Princes, at the instigation of the Maharajah of Gwalia, for the use of the Indian Expeditionary Force.

ATTENDANCE ON THE NAVY.

One of the heaviest taxes on the Mercantile Marine caused by our Naval and Military forces was the provision of ships for *Transport and Supply* purposes. Taking the *naval* requirements first, a very large fleet of ships was requisitioned by the Admiralty for the use of the Grand Fleet and other portions of the Navy. The first need was *Colliers.* At many of the Fleet bases no facilities existed for the storage of coal, and the whole supply had, therefore, to be stored afloat in the colliers which brought it to the bases. This was naturally a method which was very uneconomical so far as the working of merchant ships was concerned, since, in order that the Fleet might be refuelled with rapidity, the presence of a very large number of colliers constantly at the bases was necessary. The alternative method was the provision of large storage facilities on shore, and the provision of jetties and wharves with deep water alongside and arrangements for landing the coal with rapidity in large quantities and the provision of a great number of lighters. At such bases as Scapa Flow, Invergordon, Rosyth, the Humber, and Mudros (in the Mediterranean) there were no store facilities, and consequently we were compelled to rely once more upon the Mercantile Marine for the work.

As with the supply of coal, so also was it in the case of oil; but oil, not being a home product, larger facilities for its storage had to be provided at our naval bases. However, at Scapa Flow there were no storage tanks, and the supplies, as in the case of coal, had to be kept afloat, *Oil Tankers* being kept in company with the Fleet. At the other bases small tankers only were needed to convey the oil from the tanks to the ships in cases where the ships themselves could not go alongside a jetty to obtain supplies from a pipe line. Large numbers of tankers were needed to bring the oil to the United Kingdom, and these vessels became the object of special attack by German submarines during the war, so that at one period considerable anxiety was caused owing to the low state of our reserves of oil fuel.

Similarly at many main fleet bases there were no magazines for the storage of reserve ammunition. Rapid replenishment after a naval action was essential, and again it was necessary to store a portion of the reserves afloat in specially fitted merchant ships, termed *Ammunition ships*. These vessels were lost to the Mercantile Marine for the duration of the war, being practically in the nature of movable hulks. *Store ships* were also required for the fleet, since storehouses were non-existent at many of our principal fleet bases. These vessels brought stores from dockyard bases to the fleets.

Provision ships were a further necessity, but neither they nor the store ships were required in any large numbers, since they usually discharged their cargoes to the naval ships on arrival at the fleet bases. There were, however, one or two exceptions, notably the canteen ship Borodino, which remained with the fleet for the supply to officers and men of simple necessities not provided by the service. She was equipped and run with great success by the Junior Army and Navy Stores. The *frozen-meat ships* were also detained longer than other supply ships on account of their cargo, and owing to the necessity for detention, one of these was utilised for recreation purposes by the fleet when in harbour.

THE CONTROL OF MERCHANT SHIPPING.

In all wars the Admiralty has found it necessary to exercise some form of control over the movements of merchant ships, but on no former occasion has the control been so pronounced as during the late war. The extended control was necessitated by the introduction of the submarine war against merchant ships, and was not even confined to our own shipping, as neutrals, for their own safety, submitted to practical control by the Admiralty.

In the early years of the war, the control took the form of prescribing routes for ships of the Mercantile Marine to follow, and in the issue of such instructions, for instance, as the necessity for steering zigzag courses when in areas frequented by submarines and the most effective method of steering such courses. The extinction of all lights at night was also prescribed, as were directions for hugging the coast in daylight, the passage through certain areas during the dark hours, etc. In the later years, when the introduction of unrestricted submarine warfare, combined with the increasing shortage of shipping, necessitated the practical control of the whole Mercantile Marine by the Government, and when convoys were instituted, the Admiralty and the Mercantile Fleet worked in the closest cooperation.

Amongst other things an elaborate system was instituted for the instruction of officers and men in the work which they might be called upon to perform under the new conditions, and great benefit was derived from this system. It would be of great advantage were the nucleus of the system to remain, so that it might be ready at hand for expansion in the hour of need. An earnest tribute may be paid in this connection to the manner in which the officers and men of the merchant service bore the heavy strain to which they were subjected. Although there were undoubtedly cases in which Admiralty instructions were disregarded and ships thereby risked unnecessarily, yet such cases were few and far between, and, especially in the later years of the war, mutual confidence between the Admiralty and the officers of the Mercantile Marine was firmly established. Lacking many of the facilities which exist in ships of the Royal Navy to assist the captains and officers of the watch in handling ships in company with one another, our merchant ships attained a degree of excellence in manœuvres which was admirable, and which tended greatly to promote safety, but the strain on the officers, and particularly on the captains, was very heavy; it is to their eternal credit that they bore the strain so well. Particularly would one desire to speak of the work of cross-channel vessels, especially those working at night in the English and Irish Channels, where the risk of collision was very great and where the utmost vigilance and the finest seamanship were always necessary.

THE MOVEMENT OF TROOPS.

The Military requirements which taxed the resources of the Merchant Marine were, first, the provision of *Transports* for the conveyance of troops from the United Kingdom, India, the Dominions and Colonies to the various theatres of war, and, secondly, their maintenance when there by the constant supply of provisions, munitions of war, food, and stores. The drain upon the Merchant Marine for these services was ever on the increase as we added to our commitments overseas. Armies were transported to, and maintained in, France, Gallipoli or Salonika, Egypt, Palestine, Mesopotamia, and East Africa; constant reinforcements were transported to the United Kingdom and to various theatres of war from our Dominions. Our transports were even used to bring the

Portuguese Divisions from Lisbon to Brest, and in the later years of the war a large army of labourers was brought from China. The vast size of our armies overseas imposed an immense strain upon the resources of the Mercantile Marine, and it was frequently only with the greatest difficulty that ships were provided to fulfil the requirements.*

Some idea of the tax on shipping which naval and military requirements levied on our mercantile marine will be gathered from the following figures, which show the number of ships suited for ocean work which were engaged on naval and military service at two different dates. The figures are :—

	Number of ocean-going steamers engaged on—	
	Naval work.	Military work.
1st September, 1915	854	450
31st October, 1918	493	542

THE PRE-WAR MERCHANT FLEET.

The naval and military work carried out by our merchant fleet having been mentioned, it remains to touch upon the method by which the ordinary and most important duty of importing food and raw materials into the United Kingdom was performed.

At the outbreak of war the net steam tonnage owned by the different maritime nations was as follows :—

	Tons net.
British Empire	12,440,000
Germany	3,096,000
United States (overseas trade) . .	1,195,000
Norway	1,153,000
France	1,098,000
Japan	1,048,000
Netherlands	910,000
Italy	871,000
Other countries	4,179,000
Total	25,990,000

Ninety per cent. of the tonnage of the United Kingdom consisted of vessels exceeding 1000 tons, suited for overseas trade, and the total number of such vessels possessed by us was 3747, representing 10,174,000 tons net. As the submarine campaign grew in intensity, so the importance of *numbers* became increasingly apparent. The tendency to increase the size of ocean-going vessels is well illustrated by the table below :—

Steamships on the Register of the United Kingdom on Dec. 31st.	1910	1913.
Of 1000 to 2000 tons net	1370	1134
,, 2000 to 3000 ,, ,, ...	1569	1599
,, 3000 to 5000 ,, ,, ...	630	804
,, 5000 tons net and over	148	210

Some 60 per cent. of our tonnage before the war consisted of what are known as tramp steamers, *i.e.* ships which do not adopt scheduled sailings on definite routes, which is the practice with the regular liners which formed the remaining 40 per cent. of British mercantile tonnage. The tramp vessels are essential for British ocean-borne trade, which could not be carried on entirely by liners.

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* 23,388,000 officers and men of the Armies, effectives, were carried by sea during the war as well as 2,336,000 ineffectives, 192,899 prisoners, 2,264,000 animals, 512,000 vehicles, 47,992,000 tons of British military stores, and 4,964,000 tons of Allied military stores.

It is as well to mention here that the British Mercantile Marine was, in pre-war days, kept efficient and up to date by the substitution of new ships for old by the sale of large numbers of the latter, to an extent greater than by other maritime nations. For instance, during the twelve months ending June, 1914, we replaced 5½ per cent. of our tonnage; Germany replaced less than 3 per cent., and the other principal nations about 3½ per cent.

FEEDING THE NATION.

The *effect of the war*, with its many naval and military demands, was to reduce by about 50 per cent. the amount of tonnage belonging to the Mercantile Marine which was available for provisioning the United Kingdom and for carrying on overseas trade, and as time went on we became more and more dependent on neutral shipping for this purpose. This was the state of affairs up to the end of 1916 as shown by the table below, which shows the percentage of tonnage under different flags of vessels entering and clearing with cargoes and in ballast at ports in the United Kingdom during the years 1914–1916.

	1914.	1915.	1916.
British . . .	61	53	51
Allied . . .	11	11	11
Neutral . . .	28	36	38

Dependence upon neutral shipping for the necessaries of life is not a situation which can be contemplated with serenity, since there is always the possibility of a neutral becoming an enemy. The institution of unrestricted submarine warfare by the Central Powers had an immediate effect upon the figures as given in the table above, as it resulted in a great reduction in the amount of neutral shipping bringing cargoes to United Kingdom ports from foreign ports. The proportion of such vessels of British and foreign nationality was—

	British.	Foreign.
In 1915	68 per cent.	32 per cent.
In 1916	67 ,,	33 ,,
In January, 1917	71 ,,	29 ,,
And in September, 1917, by which time the worst of the unrestricted submarine campaign had passed, the figures had become	83 ,,	17 ,,

The natural result was a reduction in the total imports into the United Kingdom owing to there being fewer vessels available for the work.

By the end of 1916 the number of British vessels available for overseas work had been reduced from 3747 to 3475, and by the end of August, 1917, this total had become about 2875. Of these vessels a considerable number were working for our Allies and not for ourselves. The figures varied, of course, and it is impossible to give them for different periods of the war, but some idea of the tax upon our Mercantile Marine in this direction will be gleaned from the fact that, at one time in 1916, no fewer than 581 British ships were engaged in work for our Allies, *exclusive* of other British ships which were at the same time carrying wheat to France and Italy.

The only ways in which the losses could be made good were—

(1) By new construction.
(2) By the release and use by the Allies and by neutrals of German ships interned in neutral ports.
(3) The release of similar ships interned in American ports and the ports of other nations which had joined the Allied cause.
(4) By getting out of the Baltic certain British ships which were in Russian ports at the outbreak of war.

Steps under headings (2), (3), (4), were taken as far as it was possible.

The table below shows how far success attended our own efforts at new construction.

Year.	Net tonnage of Merchant Ships launched in the United Kingdom during 1914 and subsequent years.
1914	exceeded 1,000,000
1915	430,000
1916	340,000
1917	714,600
1918	958,800

It may be of interest to state that during the Napoleonic wars, and in spite of the heavy losses suffered by our Mercantile Marine, both before and after Trafalgar, there was a steady increase in Merchant Shipping from the year 1790 to the year 1815, the total increase in this period being 409.

RESTRICTION OF IMPORTS.

The natural effect of the losses sustained by our Mercantile Marine, combined with the use of so large a portion of it for naval and military purposes, was that a great reduction took place in our imports. And as imports of war material and food were essential for the continuance of the war, the reduction was of necessity effected in other directions.

	Tons per annum.
Our pre-war imports averaged about	58,000,000
In the year 1914 the average was	51,000,000
" " 1915 " "	49,500,000
" " 1916 the figure was	43,000,000
" " 1917 " "	36,000,000
" " 1918 " "	36,000,000
" " 1919 " "	41,500,000

In the years 1913 and 1916 these imports were classified under the following headings:—

	1913.	1916.
Food stuffs	14,000,000 tons.	15,000,000 tons.
Raw materials, manufactured goods for Industries and Commerce	44,000,000 "	15,000,000 "
War material	nil	13,000,000 "
Total	58,000,000 "	43,000,000 "

The effects upon our export trade is shown below :

The exports of United Kingdom produce and manufactures to *all* countries were valued in	1913	at	£525,000,000
On the 1913 price level the figure in . . .	1916	became	£386,000,000
Similar figures for exports to British Dominions gave in	1913		£205,000,000
and in	1916		£140,000,000
And similar figures to neutral countries gave in	1913		£132,000,000
and in	1916		£96,000,000

Such, therefore, was the effect of the war upon trade, and the figures quoted above convey some idea of the absolute dependence of the Empire upon our Mercantile Marine, not only for its prosperity but for its very existence. The work of the navy, the activities of the army, the production of munitions, and the feeding of our people could none of them have been by any possibility carried out had the strength of the British Merchant Fleet been inadequate at the outbreak of war. This is a lesson which the British people and our kith and kin in the Dominions and the Colonies would do well to take to heart. Let it be realised that the Sea is our Life, so that nothing may ever be done in the future which might result in reducing the strength and the efficiency of our Mercantile Marine.

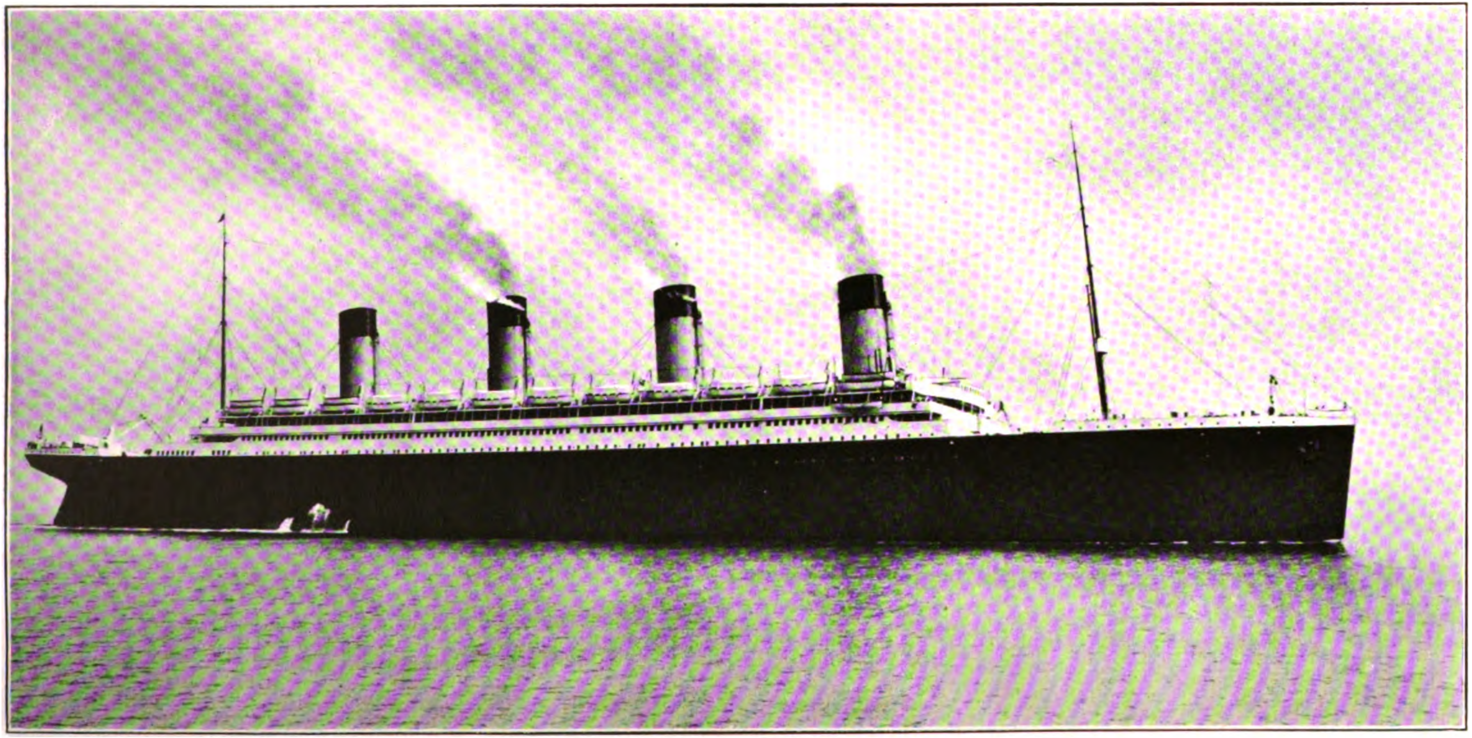
This article so far has dealt with the material of the Merchant Fleet. Its personnel is at least of equal importance, for it was the personnel which faced with unflinching courage all the horrors that an inhuman enemy, with complete disregard of the laws of nations, could inflict upon it, and by so doing upset all his calculations and made victory possible. 14,721 of our British Merchant seamen gave their lives for their country in ships and in fishing craft during the war, exclusive of large numbers of R.N.R. officers and men who made the supreme sacrifice whilst serving under the White Ensign. Whilst the British Empire continues, the services of its Merchant Seamen should ever be remembered with the deepest gratitude, and the British people may well go on their knees in thankfulness for the spirit and efficiency which animated the personnel of that great Service.

We naturally learned many lessons during the war, and it would be well to profit by those lessons. The intimate association between the two Sea Services of the Empire which became ever closer as the war progressed, was one factor from which great advantages resulted. We should endeavour to retain this close association, so far as is possible, under conditions of peace.

Any form of control by the Admiralty, or any other Government Department, over the Mercantile Marine is, of course, unthinkable, but it would seem possible that the close association and co-operation of one or two leading men of the Shipping World (representing the whole Mercantile Marine) with the Board of Admiralty *in an official capacity* might be an advantage, so that close touch between the Services could be maintained by a mutual exchange of views to the benefit of the whole Empire.

When it is borne in mind that, at the time of the conclusion of the armistice, 3800 officers and 16,347 ratings of the Mercantile Marine were on Naval Pay, it will be seen that there is reason to consider the two Services as one, and, that being the case, there is every justification for the views of the Merchant Service being very clearly represented at the Admiralty.

JELLICOE.



THE WHITE STAR LINER OLYMPIC.

Built and engined by Messrs. Harland & Wolff, Ltd., Belfast.

(*For particulars see p.* 329.)

CHAPTER II.

PASSENGER LINERS.

IN 1892 an article by the present writer was published in an American magazine on the future of passenger ships, and the editor of the magazine, after reading the article, gave it the title: "30 knots to Europe." Those who know that the maximum speed obtained across the Atlantic is not much over 26 knots, will realise that that prophecy was not fulfilled. That reminiscence supplies a warning. It should, however, be added that the elements of the "30 knots to Europe" were oil fuel, high duty water-tube boilers, and fast running reciprocating engines. The 26 knots across the Atlantic was obtained with coal fuel, ordinary marine boilers, and slow running turbines. The boilers and the fuel in the Lusitania and Mauretania, which were designed about 1906, were the same as were in use in 1892 when the prophetic article was written. Marine turbines did not become an accomplished fact until 1897, although their adaptability to high powers had been foreseen before 1892. Great consideration has consequently been exhibited in furnishing to such a prophet another opportunity to say something about the future. Fortunately it does not much matter to those who read this article whether the suggestions made on this occasion turn out to be correct or this new prophecy proves to be as inaccurate as the former one.

Taking the Lusitania and the Mauretania as the high-water mark of speed on the Atlantic, it will be interesting to recall some incidents connected with their inception. The first Lord Brassey was always interested in the connection between the Navy and the Mercantile Marine, and his suggestion to the Institution of Naval Architects that it should consider the possibility of merchant ships becoming valuable additions to the Navy in time of war, led to the appointment of an Admiralty Committee—called the Mercantile Auxiliaries Committee—to report on the question of the relation between speed and cost, with a view to enabling the Government to determine what subsidy should be paid for the attainment of speeds above the highest possible commercially. At the time this Committee was formed the Americans had made a very serious attempt to capture the Atlantic trade. A great combination was formed and apparently controlled by Americans, which included the majority of the effective passenger ships on the North Atlantic, and it seemed as if they and the Germans between them would leave us in the third place. The prestige of the flag seemed to be in danger, and the Government encouraged the bold attempt to retain, or may it be said recover, our prestige on the North Atlantic. To obtain the highest speed seemed to mean a high subsidy, and on the report of the Mercantile Auxiliaries Committee it was decided to encourage the Cunard Company by lending them money at a low rate of interest, and by giving them an additional subsidy to recover and retain our prestige. The result of this decision was the construction of the Lusitania and Mauretania. Whether these vessels ever lost as much money as the subsidy granted to them, only those who are familiar with the cost accounts of these two vessels could possibly tell.

The question of profit made by individual ships is not the last word in determining the policy of building such ships. The latest ships and the fastest ships are always popular, but their popularity tends to draw away from the older ships, passengers who would travel in them, and so robs the fleet at one end to make it pay at the other end. But the success of the Cunard Company in retaining and improving its high position on the North Atlantic is some justification for the subsidy given them at the critical time in the history of that line, and in the history of the British Mercantile Marine in the North Atlantic. These subsidies were given in economic times when money was cheap and plentiful, and when our statesmen and working people did not think in the same high costs as is the case to-day.

INCREASED COSTS.

The costs of building and running ships have increased four-fold since pre-war times. Sir Thomas Fisher, the General Manager of the Canadian Pacific Ocean Services, recently gave some figures which were startling to those who had not had the opportunity of knowing what the advances in wages really are, and what they have amounted to in their effects on the economics of ship owning. He stated that the ship with the sea speed of 18 knots running on the North Atlantic which would have cost £550,000 before the war costs £1,700,000 to-day. The total running expenses of such a vessel for a round voyage before the war cost about the same as the cost of Insurance, Depreciation, and Interest on Capital alone would cost to-day, and in addition to this there is the coal bill, which before the war cost £4500, and to-day costs £24,000; repairs cost £1700 before the war and now are £7700 per round voyage. The cost of food for the ship has increased from £3000 to £8000; the cost of wages has increased from £2500 to £9000. The rise in wages alone does not represent all the increased cost of the crew, because allowance has to be made for reduced accommodation for passengers, which is now needed to meet the demands of the crew for greater comfort. In an 18-knot ship finished just before the war, and now fitted to meet the modern requirements of the crew, 266 berths have had to be given up in the passenger part of the ship to suit the requirements of the crew to-day. This involves a loss of £5000 per round voyage on the passenger earnings, so that, in all, the total cost of running such a ship is £60,000 per round voyage more than a similar ship cost before the war. This increased cost has to be recovered from the passengers. First-class passengers used to pay

£19, now they pay £50. Second-class passengers used to pay £11, now they pay £28. Third-class passengers used to pay £6 10s., now they pay £19. The bulk of the people who travel are to-day no better off in relation to the expenses they have to meet than they were before the war, and the question of how long they can continue to pay these increased rates is one which must be settled before the future of Atlantic travel by passengers can be predicted. Since the resumption of passenger traffic on a large scale may be temporarily due to the return of the nations to their homes, it would have seemed that the present time was not very opportune for the reduction of passenger spaces to meet the demands of the crews. It is perhaps not too far fetched to say that this demand of the crews is similar to the demand of every railway guard for a first-class compartment to himself, except that the effect of such a demand on train travel would not be so great as is represented by the reduction of 266 berths in a passenger ship.

Effect of Hard Times.

In the hard times, which are not very far off, we may readily expect a great reduction in Atlantic travel, and the increased cost of running expenses will have in some way to be met if the ships are to continue to be run. The 18-knot ship, which is by no means a fast ship compared with the Lusitania or Mauretania and many others, would, if its speed were reduced to 15 knots, be able to save about enough in the cost of fuel to pay the extra wages which the crew now have to be paid. The saving on the first cost due to the reduction of speed would very nearly pay for the extra cost of repairs, but there would still be a great proportion of the extra cost of running the ships to be paid by the passengers, so that with the reduced numbers that are likely to be carried in the hard times in front of us, it does not look as if there is much prospect of any reduction in the passenger fares. Most passenger ships carry some cargo, but if the passenger department does not pay it is doubtful whether the cargo revenue will make up sufficiently to enable the passenger vessels to continue to run, even at the reduced speed indicated above. All these restrictions will inevitably tend to decrease the amount of travel, and will tend to bring the peoples of the Empire and the world together less, instead of more, in the future, which will not be an advantage to trade or to the good fellowship of the world.

Diesel Engines for Ship Propulsion.

Reliance must be placed in improved systems of construction and propulsion. The only hope at present in sight is in the general adoption of the Diesel engine, whose economy over the next most economical system is represented by a reduction in fuel consumption of from one-half to two-thirds of the total fuel consumption. So far, in mercantile ships, the Diesel engine has only been applied to comparatively slow vessels on account of the small total power which it has been practicable to develop in Diesel engines. There are signs, however, that this amount can be considerably increased, and we may before many years be able to get enough Diesel-driven engines into one ship to drive it at as high a speed as 15 knots. The type of Diesel engine which has been so far adopted is one which is connected directly to the propeller; the engine is run at about 120–140 revolutions per minute. Diesel engines have been used for submarines, which run at as much as 400 revolutions. These are necessarily lighter on account of the increased revolutions, but to apply their power to efficient propellers some form of reduction gearing, either mechanical or electrical, must be introduced, as the propeller is most efficient at low revolutions, while the engine is most efficient at high revolutions. So far nothing has been done in either direction in the Diesel engine to take advantage of its possible high revolutions.

In the turbine it has been possible by mechanical gearing to make considerable gains in efficiency by gearing down from the 3000 or 4000 revolutions of the turbine to the 100 revolutions of the screw by adopting double reduction in the gearing. No such gain can be expected by mechanical gearing in the case of the Diesel engine. In the case of the turbine it has been possible to gear down by the introduction of dynamos and motors, although this has not been adopted on any large scale except in the case of some American battleships. The cost of electrical transmission is greater both in first cost and in running than that of mechanical gearing, and it is very doubtful whether the former can ever compete with the mechanical transmission in either of these respects.

There seems, therefore, to be no great advance in sight in the development of high powers in Diesel engines such as has taken place in the turbine in the last twenty years. The gain in fuel economy represented by one-half to two-thirds may, however, be always attainable, and this will lead to further economies due to carrying less weight of fuel and to a gain in cargo spaces and freight-carrying in consequence. These gains may be translated into a further reduction of fuel space and consumption by making finer ships, thereby increasing the speed without greater increase of running expenses. We are at the beginning of a new development, the effect of which is all in favour of economy, provided that the supply of oil fuel is sufficient for all the world's purposes without increase of cost per ton of fuel used, but the rapid increase in the applications of oil to power purposes must be taken into account in relation to the growth of the supply of oil. Until we can get fixed figures for these things it is quite impossible to predict what the future of passenger ships will be.

We have not yet achieved the full advantage of the turbine. Oil fuel and superheat are being applied to high-speed passenger vessels for the production of steam for turbines of high efficiency due to their great revolutions. Double reduction gearing is in process of being applied to these economical high-revolution turbines. Propellers are to be run at 90 to 100 revolutions per minute by the interposition of double reduction gearing which receives its power from turbines running at 3000 revolutions per minute. The effect of the high economy of the slow running propeller and the very fast running turbine, assisted by oil fuel and superheat, is expected to produce a horse-power for nine-tenths of a pound of fuel per hour. This is a great advance upon the 1·5 to 1·6 lb. of coal per horse-power per hour which the coal-fired boiler and the reciprocating engine require. But there is a long gap between even the economy represented by nine-tenths of a pound per horse-power hour and that of three to four-tenths of a pound which has been obtained in Diesel engines. There is therefore a great field for increased economy in sight for the immediate future which will help in meeting the difficulties which may arise in the near future on account of the probable limited supply of oil.

J. H. Biles.

CHAPTER III.

THE TRAMP AND WORLD COMMERCE.

THE tramp steamer is the general servant of commerce; it goes about the seas searching for cargoes which can be carried to their destination at a profit, frequently a very meagre profit. Some years ago a sense of delicacy towards the feelings of the tramp owners led to these ships being frequently described as "seekers." It was thought that there was something rather derogatory about the term "tramp." The usual human tramp was regarded as a ne'er-do-well who wandered on foot from town to town and village to village begging his food at wayside doors, sleeping by night in barns or under hedges, and sometimes varying the monotony of his existence by relieving careless householders of articles of clothing and other things. Some of the more sensitive owners of tramp ships used to protest that there was little or no similarity between the tramp steamer and the down-at-heel wanderer with "no visible means of subsistence." The self-respecting shipowner urged that his vessels might be described as "tramps" on account of their moving from port to port without any previously regulated schedules of sailings, but there the analogy ended. Of late years the vessels which wander over the seas, following the economic current, and seeking for cargoes wherever they may be on offer, have come to be generally described as tramps without any *arrière pensée.* We have, indeed, reason to be proud of our tramps, for they have hitherto formed the backbone of British shipping. British individuals and British firms have shown for many years something amounting almost to genius in the successful management of these craft. They contribute materially to our national prosperity and tend indirectly to keep down the cost of living in this country, where a man and his family may still exist at a high standard of comfort on a smaller income than anywhere else in the Western hemisphere.

THE MISSION OF THE TRAMP STEAMER.

As was pointed out in the Report of the Departmental Committee on Shipping and Shipbuilding (1918), the British carrying trade before the war was divided between the regular lines, with regular sailings which traded on definite routes, and owners of vessels engaged in general trade, or tramp owners, whose vessels were often chartered to third parties and traded wherever a cargo might be found. The well-known lines ran passenger vessels and also cargo vessels "generally of a higher type and speed than ordinary tramp vessels, but there was always a class of vessels on the border-line between 'liners' and 'tramps' which might be of service in either capacity as occasion required." The Committee accepted a sea-speed of 12 knots as marking the dividing line between what might be described as "liners" and the ordinary "tramp" steamer. On this assumption, it was calculated that before the war 60 per cent. of the British tonnage might be roughly estimated as consisting of tramps and 40 per cent. of liners. This conclusion is directly opposed to the popular conception of the character of British shipping, for the tendency has always been to think in terms of liners and to forget the very essential tramp class of tonnage. The liner fulfils important functions in the ocean-carrying trade as well as in the transport of passengers, but the success of the British Mercantile Marine depended in the past on the economic balance which was maintained between liner tonnage on the one hand, and tramp tonnage on the other. This Committee, which was presided over by Sir Alfred Booth, Bart., the chairman of the Cunard Steamship Company, devoted a paragraph in its report to an explanation of the mission of the tramp shipowner.

> Not only was he responsible for the larger part of our steam tonnage, but we were dependent on him for the import and export especially of what may be termed the rougher class of bulk cargoes which are not as a rule suitable for the liner business. It would be impossible for a country like the United Kingdom, with its enormous flow of trade, to depend wholly on regular lines with scheduled sailings. It is essential that there should be a large amount of 'loose' tonnage capable of supplementing the liner sailings, and prepared to trade at short notice to any part of the world. Yet, precisely because of his ubiquitous presence, the tramp owner's difficulties are the least easily defined and met, and he is peculiarly susceptible to any serious modifications of the conditions under which shipping is carried on. In an inquiry such as ours, which is bound to take account of particular trade routes, there is a real danger that the interests of the tramp owner may not appear to receive the full weight which they merit.

A Popular Misconception.

The tramp steamer in complexity of construction and speed does not, of course, bear comparison with the great liners, but the differences between the two are often exaggerated by those who have little or no first-hand experience of the British sea-carrying trade. Some years ago a writer on the American Marine in his efforts to encourage the shipping movement in the United States, made a number of statements which are only now of importance because there is reason to think that such opinions are still held by many persons. It is quite true, as this writer remarked, that steamers in the early days were so costly to run that they had to be formed into lines, have a regular route, a large passenger traffic, and a subsidy from Government for carrying the mails. It is also, at any rate partially, true that only since the near perfection of the screw-propeller engine vessels under steam, fitted for cargo carrying alone, have dared to venture forth on irregular voyages, trusting to luck for engagements. And then this writer continued his remarks on the tramps:—

> Necessarily the utmost economy and the deftest skill were requisite in their design, build, outfit, and management, as their competition would be against the

regularly subsidised lines on the one hand, and the cheaper-run sail ship on the other. Moderate success attended the enterpise, which was, for the most part, started and since then followed up by British builders, who have become accustomed to carrying a stock account of such vessels. They are vulgarly known as "tramps." Many of them have been recklessly built and worked off on the market to keep shipyards a-going in dull times. Parsimony and dishonesty have sometimes taken the place of economy and skill. The very poorest ship material goes into tramps. The very lowest of job wages are paid for their construction. They are sold for almost any price that can be obtained, since, in many cases to more or less extent, they represent an output of odds and ends of material and labour that could not be converted into money in any other way. In other words, steam tramps, as a general thing, are not custom but slop made. They are built by all classes of builders, the good, the bad, and the indifferent.

There is an element of truth in some of the statements of this American writer, but, on the other hand, the general impression which he conveys—and he has many imitators—as to the character of the British tramp steamer is grotesque and absurd. The picture of the tramp as a crazy and more or less unseaworthy carrier of sea-borne commerce, stands exposed on the slightest examination. In the first place, the tramp steamer is insured against loss, and the underwriter, interested in hull and cargo, is as concerned for the safety of the ship as the owner and charterer. Every vessel has not only to satisfy the requirements of the Board of Trade, responsible for the enforcement of legislation intended to ensure the safety of officers and men, but in practice has also to satisfy the requirements of Lloyd's Register, or some other reputable classification Society, who require the same standard of quality of material for all vessels. In the strictest sense of the term, Lloyd's Register may be described as a British institution, since its head office is in London, but, on the other hand, its specifications are of world-wide application, and the regulations which apply to British tramp steamers apply equally to 64 per cent. of the seagoing steel and iron merchant tonnage of the world. That statement leaves out of account the check on faulty construction, which is also imposed by the other British registration society, the British Corporation. Apart altogether from the humane sentiments which animate the owners of tramp steamers, and the precautions enforced by the Board of Trade, Lloyd's Register or other registration society, representing as they do underwriting as well as other interests, the officers and men would themselves have something to say if the ships in which they served were not "tight, staunch, and strong" as well as well found.

But the matter may be pursued a stage further. Bearing in mind that 60 per cent. of the British Mercantile Marine on the eve of the war consisted of tramp tonnage, Sir Alfred Booth's Committee shed interesting light on the general character of the ships under the British Mercantile flag. Every year some 600,000 tons net, or nearly 5½ per cent. of the total tonnage, was removed from the United Kingdom Register for one reason or another; two-thirds or 400,000 tons were sold to foreign flags. The deficiency was made good by new ships. In this connection the Committee stated conclusions which deserve the widest publicity.

This fact of the transfer of large numbers of our older vessels to foreign flags was of great importance in connection with the development of our mercantile marine, and it cannot be overlooked in the consideration of future policy. It means that our shipowners were afforded a ready market for the disposal of vessels no longer satisfactory to them as a preliminary to the purchase of new vessels better suited to their purpose, and that the merchant tonnage of foreign countries as a whole was older, and therefore less efficient, than the tonnage of the British mercantile marine. It illustrates the process of growth which continually kept the British mercantile marine ahead of its rivals, and, being of a spontaneous development, is more conclusive evidence of high efficiency than could be afforded by any amount of written testimony.

Lloyd's Register book, showing the number and gross tonnage of vessels added to and deducted from the merchant navies of the United Kingdom, France, Germany, Italy, Norway, and Sweden, in the twelve months ended June 30, 1914, supplies other evidence pointing in the same direction. A high percentage of new vessels, and a low percentage of vessels lost and broken up, must be accepted as signs of efficiency. The proportion of new vessels added to the Register was 97 per cent. of the additions in the case of the United Kingdom, while the percentage for Germany was 85, Sweden 62, France 61, Norway 59, and Italy 12. Similarly the proportion of tonnage lost or broken up reflects upon the unseaworthiness of the ships and the manner in which they were handled; of the total British losses the percentage due to unseaworthiness was only 24, and that of Germany 33, while the percentages in the case of Norway, Sweden, France, and Italy were 49, 53, 58, and 66 respectively. No less than 85 per cent. of the tonnage on the Registry in the United Kingdom on the eve of the war had been built since 1895, including 68 per cent. built since 1900, and 44 per cent. built since 1905. No other mercantile marine could show such gratifying figures. It is apparent that there is no foundation for the suggestion that British tramp steamers, constituting 60 per cent. of the British Mercantile Marine, were either badly built, or ill found, or old.

ITS FUNCTIONS.

There is a tendency to look down upon the tramp steamer because it is slow, and the fashion is to demand speed, particularly since the aeroplane, travelling at 150 or more miles an hour, was developed, unsettling accepted ideas already strained by the high rate of running of the motor car. But the tramp is not a ship of pleasure, and is not as a rule engaged on urgent business. It usually moves at what is found to be the most economical speed, which ranges from 8 to 9 knots. If a cargo, owing to its perishable character or other cause, has to reach its destination more swiftly, then some other class of vessel will be chosen; but there is an immense volume of commerce by sea which will not repay the cost of high speed. Only the shipowner realises perhaps what a few extra knots involve in money and how quickly the running charges rise as soon as the economic rate is exceeded. Thus, by general agreement, the tramp steamer, whatever its national flag, steams only slowly. What influence the increased wages of officers and men, and the higher cost of production and upkeep, may have on the speed of the tramp steamer opens up considerations which cannot be discussed here and now; but it is apparent that the conditions which obtained in the past have undergone radical changes. An A.B. now draws about three times as much money every month as he was receiving on the eve of the war, and the charges for food and stores are also much heavier. On the other hand, the price of coal has also advanced and is not likely to fall for some time. That upward movement constitutes another factor which cannot be ignored in any reconsideration of the economic factors which govern the design and management of tramp tonnage.

If we are to regain the position at sea which we occupied on the eve of the war, we must not ignore the important functions fulfilled by the tramp steamer. More than half of the world's sea-borne trade was carried in British ships, including nine-tenths of the inter-Imperial trade, over three-fifths of the trade between the Empire and Foreign countries, and nearly one-third of the trade between Foreign countries. We owe our pre-eminence not merely to the efficiency of the shipping services which we rendered, but also to the geographical situation of the United Kingdom—to its strong industrial position as the centre of a world-wide empire with many coaling stations and ports of call—and finally—if indeed not mainly—a large coal trade which provided ships with outward freights, thus reducing the burden of freights on the inward cargoes of food and raw materials.

The value of imports into the United Kingdom during 1913—the last year in which normal conditions prevailed—amounted to £769,000,000 and their weight may be estimated at 55,000,000 tons. Our exports (including re-exports) on the other hand amounted in value to £635,000,000 and in weight probably to about 100,000,000 tons, of which coal accounted for 76,000,000, its value being only £54,000,000. *

NATIONALISATION.

In the recent discussions on coal nationalisation, there has been a tendency to ignore the importance of cheap coal for export and for bunkers, but a moment's consideration suggests that cheap coal in plentiful supply lies at the very basis of our national prosperity and is essential to the realisation of our hopes of re-establishing the British Mercantile Marine. If the miners' leaders had recognised the opportunity which the post-war period offered to those they represent, they would have preached, in season and out of season, the gospel of production. For owing to the destruction wrought by the Germans in the northern coalfields of France and other disturbing factors on the Continent, the end of the war found France, Italy, Scandinavia, and other European countries, as well as the States of South America, confronted with a coal famine. There was practically no limit to the amount of coal which they were prepared to buy at high prices. It has been calculated that if the British coal mines in 1920 had been producing at anything approaching the level of production of 1913, this country would have profited by foreign coal exports to the extent of £200,000,000 over and above the sum which we shall actually receive. In these circumstances, not only would

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* Report of Departmental Committee on Shipping and Shipbuilding.

the miners have been entitled, under the sliding scale or under the conditions governing control by the Government, to a higher wage, but a large volume of employment would have been provided in this country at the waterside, and an important contribution would have been made to the re-establishment of our shipping. Owing to the failure in coal production, exports have been cut down and thousands of ships have been leaving our ports either half filled or in ballast, with the result that the cost of carriage on inward cargoes has been greatly increased. No one who takes a wide view of this and other incidents in the readjustment of the relations between capital and labour, can fail to be struck by the want of wisdom exhibited by some of those who should be the leaders of the working classes of this country.

Down to the outbreak of war this country possessed a volume of tramp tonnage * far in excess of its own requirements, and the margin employed in trading between one foreign port and another foreign port constituted the essential reserve which was drawn upon during the intensive submarine campaign. This was one, if not the, determining factor which enabled the Allies to win the war. The nation evidently has little conception of the contribution which the tramp makes to national prosperity. Sir Douglas Owen † has quoted the case of a Glasgow tramp steamer which went almost twice round the world on her first voyage, and this experience illustrates the function fulfilled by no mean proportion of British tonnage. She left Glasgow for Philadelphia, in ballast, and loaded oil in cases. This cargo she took out to Japan, going round the Cape to save Canal dues. From Japan she proceeded to Brisbane and Australasia, probably carrying rice under charter. From Tasmania she went to Bombay, whether in ballast or carrying cargo does not appear. From Bombay, possibly with a certain amount of cargo for Buenos Ayres, she proceeded to Burmah and loaded cargo for the River Plate. There she discharged part of her cargo and carried the rest on to Chilian ports. Thence, in ballast, she sailed for San Francisco and Portland, Oregon, where she loaded up, probably with flour and canned stuff for Japan; and from Japan to Java, where she shipped a cargo of sugar for Greenock. These particulars of the voyage of one ship are applicable in varying degree to thousands of British ships. The tramp steamer from a British port, having obtained an outward cargo, noses her way over the seas, seeking remunerative cargoes. She has no scheduled route, but goes from port to port in search of profitable employment.

During recent discussions on the question of nationalisation of shipping, many writers and speakers have assumed that ship management is an easy matter. It is, on the contrary, an art—one of the arts of commerce—where individual initiative, knowledge, and experience count for almost everything. The shipowner or the ship

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* It has been estimated that over 30 per cent. of British tonnage was engaged in performing shipping services for other countries. This could never have been done under any system of nationalisation.

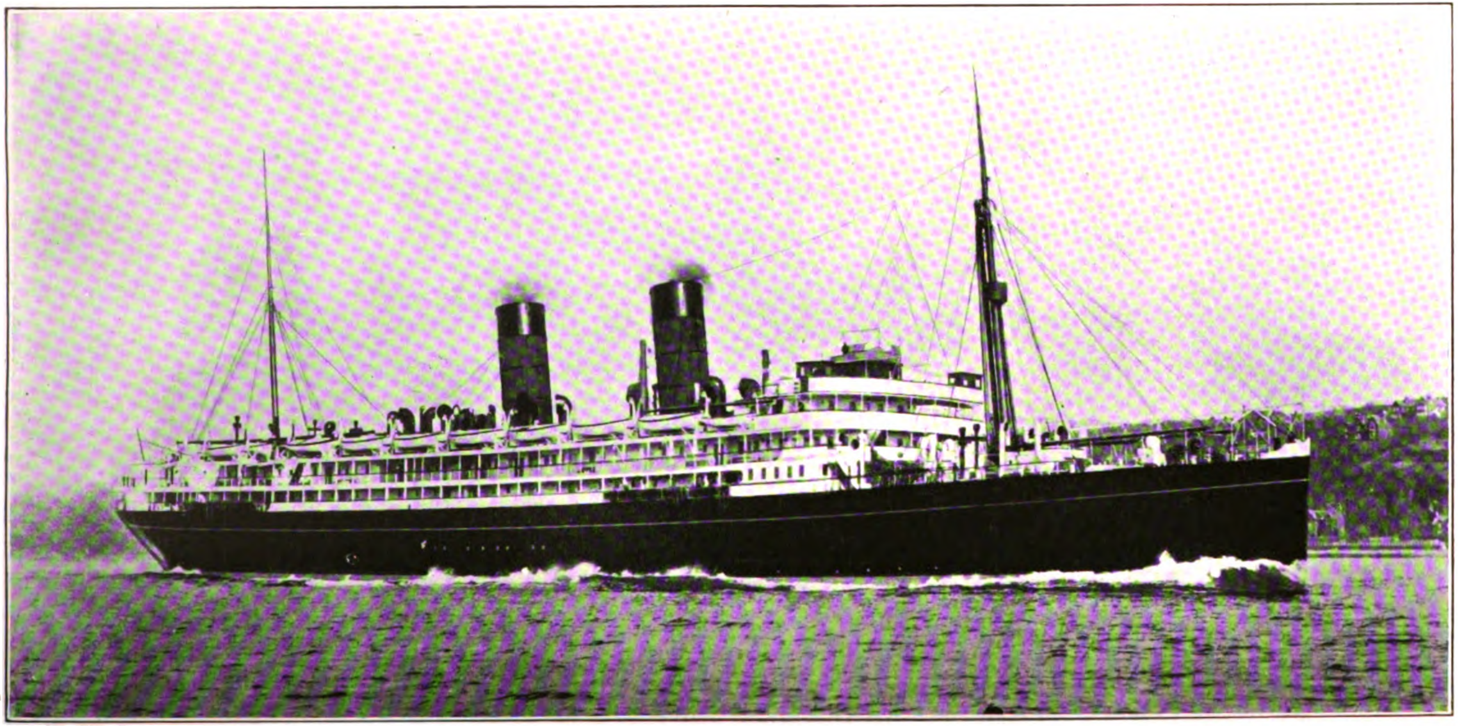
† "Ocean Trade and Shipping," by Sir Douglas Owen (Cambridge University Press).

charterer has to have his ear open to catch the earliest news of any economic movement in the East or West, if he is to succeed. He must know something of political events which are likely to occur far overseas and must estimate their influence on the economic life of the people concerned. He must also study the influence of weather on crops, and he must keep himself informed of the needs of various communities if directions are to be given to his vessels to make for ports where remunerative cargoes may be obtained. Is it imagined that under any system of State control these qualities would be exhibited by State-paid officials nervous of taking risks?

THE TRAMP AND NATIONAL PROSPERITY.

No one who looks out over the world can fail to be impressed with the important mission which British shipping, and particularly the British tramp steamer, must fulfil if the economic stream is once more to flow smoothly and swiftly. There was never a time in the world's history when shipping was of such paramount importance as it is to-day. Under the pressing influence of war, vessels had to be taken off the outer seas in order to enable the Allies to achieve victory, and it is now a matter of urgency that our shipping should be re-established since on it depends in large degree the prosperity of this country, dependent for most of its food as well as its raw materials on overseas supplies which must come to it in ships. The latest shipbuilding returns suggest that we shall soon have made good the losses sustained by the war. The tonnage problem is being solved, but that is not the only problem. It is no good possessing a large volume of tonnage unless employment can be found for it. That is a matter for the individual rather than for the State. Fortunately the shipping industry is one of the most important industries of this country, with traditions handed down from generation to generation, with the accumulated knowledge of many years, and with vast experience. The first essential, particularly for the tramp steamship owner, is freedom, and once freedom is regained the outlook will improve in promise.

W. J. NOBLE.



THE ROYAL MAIL STEAMER NIAGARA OF THE UNION STEAMSHIP COMPANY OF NEW ZEALAND.

Built and engined by Messrs. John Brown & Co , Ltd., Clydebank, N.B.

CHAPTER IV.

THE WILLIAM FROUDE NATIONAL TANK AT THE NATIONAL PHYSICAL LABORATORY.

IT is now about fifty years ago that the late William Froude constructed a "Tank" near his house at Chelston Cross, Torquay. The immediate object he had in view was to ascertain by means of experiments on a ship model several feet in length, ranging up to 15 or 18, the indicated horse-power necessary to propel a given ship at a given speed. A co-related object was to obtain, by means of tentative alterations in the lines of his model, another set of "lines" which would require the least indicated horse-power to propel the vessel at the given speed, while retaining all necessary conditions of displacement, stiffness (metacentric height), range of stability, and such others as had to be embodied in the design. By means of intuitive mathematical reasoning peculiar to himself he had arrived at the conclusion that the resistance of a ship to propulsion is made up almost entirely of two parts, viz.: (1) frictional resistance of the water over the skin, or outer bottom of the ship; (2) the resistance of the ship caused by the waves she creates by her motion through the water. Also that to these was to be added a third element which would always be small in a well-designed ship, with a sufficiently fine after body, which he called "Eddy Resistance," and which is caused by the unavoidable bluntness of form at the bow, stern-post, back of rudder, shaft brackets in twin-screw ships, etc. A further conclusion reached by him was that each of these elements could be accurately evaluated by means of model experiments in his "tank," provided that the model was towed at a suitable definite speed, calculable in each particular case, in comparison with the speed of the actual vessel, and that the ascertained resistance of the model was translated into the actual resistance of the given full-sized ship by a suitable method, the details of which he gave in exact mathematical formulæ.

These conclusions are all matters of commonplace at the present moment with all naval architects and mathematicians who have devoted their attention to this subject. Fifty years ago, however, the case was very different. At that time, Mr. Froude's theories were in many quarters considered as being more or less visionary, and not acceptable apart from a large amount of practical confirmation. At present these theories are accepted as being as true as the multiplication table: they have been extensively adopted in the designs of warships for our own and other Royal Navies, and also in the case of many steam merchant ships, both liners and cargo-carrying vessels.

As the present number of this "Annual" has enlarged its scope so as to include a much more extensive notice of matters relating to Merchant Shipping than was formerly the case, it has been thought that it would be welcome to some of the members of the Mercantile Marine, and others who have not yet fully availed themselves of the advantages derivable from tank experiments in connection with proposed new designs of ships, to have a short account placed before them of Mr. W. Froude's work in connection with this matter, leading up to the construction of the William Froude National Tank at Teddington. This chapter is an attempt to accomplish this object.

TESTING THE VALUE OF MODEL EXPERIMENTS.

As stated above, much doubt was at first expressed, still more was felt, respecting the value of W. Froude's work. The first step taken in obtaining confirmation of W. Froude's theories, and carrying conviction to the minds of those who doubted, was that of towing a model of the then H.M.S. Greyhound in the Froude Tank at Torquay and subsequently towing, in the sheltered waters of the Solent, the actual Greyhound herself.

It was the privilege of the writer to be one of W. Froude's assistants on these towing experiments of the actual ship, and to some extent also during the time the detailed numerical comparison was being made of the results obtained with the model and those obtained with the actual ship. An adequate discussion of the results obtained, triumphantly carried conviction of the truth of Froude's theories to all who were competent to form an opinion on the subject.

The experiments were carried out with the most scrupulous care, and the keenest desire to arrive at the plain, naked truth. Mr. G. P. Bidder, an eminent civil engineer, who in his boyhood was known as a prodigy in rapid mental calculations, collaborated with W. Froude in the designing of methods to be adopted in carrying them out. Mr. Bidder was present on several occasions on which the experiments were being made. Mr. H. M. Brunel, son of the eminent engineer, Mr. Isambard Brunel, attended most of the experiments, and so also did Mr. R. E. Froude, son of W. Froude. Some of the experiments were also attended by Professor W. Macquorn Rankine, and other eminent scientists. Everything possible was done to ensure that the comparison between the results obtained on the trials of the actual ship, and the trials on the model in W. Froude's Tank was properly made, and that nothing was left to what might be called natural, but possibly ill-directed, enthusiasm on the part of W. Froude himself. A very full account of these experiments and the deductions derivable therefrom appears in the 1874 Volume of the "Transactions of the Institution of Naval Architects." None of W. Froude's conclusions has been in any way shaken by subsequent work. They are accepted to-day as they have been from that time as quite indisputable.

The Admiralty very soon concluded that a new and very powerful means of investigation was placed at their disposal, and in order that Mr. Froude should have the assistance of a trained Naval Architect they placed on his staff Mr. Philip Watts, then serving at the Admiralty as a young Naval Constructor. Mr. Watts worked with W. Froude in this capacity for some time. As is well known, he afterwards became Sir Philip Watts, Director of Naval Construction, and the designer of the principal units of the Fleet, inclusive of the "Dreadnought" type, that constituted the Royal Navy at the outbreak of War with Germany in 1914. There can be no doubt that the success of Sir Philip Watts' designs both while he was Director of Naval Construction, and in the earlier days when he was Naval Architect and General Manager of Armstrongs' Elswick Shipyard, was due, so far as ease of propulsion is concerned, in no small measure to his early work at the Torquay Tank.

THE GOVERNMENT TANK AT HASLAR.

The late Sir Nathaniel Barnaby was the Director of Naval Construction at the Admiralty at the time of the initiation of W. Froude's tank work. He very soon realized its value and fully availed himself of it in his designs for the Royal Navy. He so strongly supported the adoption of W. Froude's methods as to influence the Admiralty to construct, at Government expense, a tank in the old Haslar Gunboat Yard in Haslar Creek, on the west side of the entrance to Portsmouth Harbour. This tank is much larger and much better equipped than was the original W. Froude Tank at Torquay. It has remained in effective operation from its completion to the present date, and has done, and is still doing, much work of many kinds of great benefit to the Royal Navy and to Hydro-Dynamical Science generally. W. Froude himself did not live to see this Tank in operation. The principal scientific results obtained in this Tank and in the Torquay Tank have been freely published in the Journals of various Societies; in particular those of the Institution of Naval Architects. Some have been published in the Records of the British Association and some elsewhere. A fairly full summary of the work of the two Froudes appears in the late Sir William White's "A Manual of Naval Architecture," which can conveniently be read by those not desirous of reading the original papers in full. The work of the Haslar Tank was superintended for many years by Mr. R. E. Froude. He has recently retired from the post. It is now occupied by Mr. Mark P. Payne, a member of the Royal Corps of Naval Constructors, and the Tank has become one of the regular sections of work under the administration of the Director of Naval Construction.

THE DEVELOPMENT OF EXPERIMENTAL METHODS.

The Tank method of investigating many problems in connection with shipping has taken deep root, and is being actively utilised by many Governments and private firms. The value of this method of investigation soon became so manifest that many tanks of the kind have been constructed, *e.g.* by Messrs. W. Denny & Bros., of

Dumbarton, at Washington, at Charlottenburg, at Spezia, at Paris, at the yard of John Brown & Co., of Clydebank, and at St. Albans, by Vickers Limited. All the tanks mentioned above are what might be called "Proprietary Tanks," to which none but their owners have right of access, although in some cases their owners have done useful work for others, and in some cases, notably those of John Brown & Co., through Mr. W. J. Luke, one of the Directors of the Firm, and Washington, through Admiral D. W. Taylor, of the U.S. Navy, have freely published the results of some of their investigations of general interest.

Sir Alfred Yarrow, formerly of Poplar, on the Thames, and now of Scotstoun, on the Clyde, and of Esquimalt, British Columbia, carefully following the matters briefly set out above, was one of the earliest among the engineers and shipbuilders of the Mercantile Marine of this country to recognise the value of the tank method of investigation. He also recognised that, with purely "Proprietary" tanks, many shipbuilders would be unable to avail themselves of this method of research, and that consequently improvement would be much slower, and much less widely diffused than if there were a Public National Tank available for all, by the payment of very moderate fees, for the performance of specific work. He consulted many of his friends on this subject, all of whom assured him that there was plenty of room for such a tank, that it was capable of doing excellent work, and that there was no reason to fear that such a tank would not be fully utilised. After due consideration he very generously provided at his own expense the money (£20,000) for the cost of constructing a W. Froude Tank at Teddington, and presenting it as a free gift to the nation. At that time the Royal Society, under the presidency of the late Lord Rayleigh, administered in all respects the National Physical Laboratory, and on being approached on the subject he most willingly took the Tank under the protection of the Society and allowed it to be installed in the grounds of the Laboratory in its present position.

The actual details of the construction of the Tank were arranged for the most part by Sir William White, then Director of Naval Construction, in association with Sir Richard Glazebrook, then Director of the National Physical Laboratory. Both Mr. R. E. Froude of the Haslar Tank, and Mr. W. J. Luke of John Brown & Co., were consulted on the subject, and they gave very fully the results of their great experience so as to assist in securing that the Teddington Tank should be in all respects satisfactory and up to date. This work involved very great labour, extending over a considerable time. It was undertaken in a pure spirit of love of Science, and of gratitude to Sir Alfred Yarrow for his noble gift, and to the Royal Society for providing such a suitable site as the Teddington Laboratory for the installation of the Tank. The Tank has earned for Sir Alfred Yarrow the heartiest thanks from many interested in Shipping matters, and, what is doubtless of much more importance to Sir Alfred himself, its work has abundantly proved that his gift has been of great benefit in increasing our scientific knowledge generally, and particularly so with respect to the industry in which he is so interested and has taken so prominent a part. The Tank has never had an idle day since its inauguration. Sir Alfred, with characteristic modesty, suggested that the Tank should be officially known as the "William Froude National Tank," and with this title it was officially opened in 1911 by the Marquis of Bristol, who was at that time President of the Institution of Naval Architects. This Institution has worked hard in the interests of the Tank, and has largely contributed to its welfare and success.

DESCRIPTION OF THE TANK.

It may be stated here that the word "Tank" as used in the present connection does not in itself, having regard to what is ordinarily meant by a Tank, convey a full meaning of what it really is. W. Froude's Torquay Ship Model Tank was a body of water 278 ft. long, 36 ft broad at the upper surface, 10 ft. deep, and approximately triangular in cross section. It was roofed over from end to end. A light railway was suspended from the roof and carried a travelling platform about 20 in. above the upper surface of the water. This platform provided sufficient space for observers, and contained self-recording apparatus showing the speed at which a model was being towed, and showing also the resistance opposed to the model when in tow. All these details were exceedingly ingenious and answered their purpose admirably. Improvements have been made in detail from time to time as experience has accumulated, but the main features have well withstood the test of actual use, and in their essentials have been embodied in all subsequent tanks.

The water space of the Teddington Tank is 550 ft. long, 30 ft. broad at its upper surface, 27 ft. broad at its lower surface, and 12 ft. 3 in. in depth. The weight of water in the Tank is approximately 5000 tons. This is sufficiently large for all ordinary purposes. In this tank the platform carrying the recording instruments and the operators, instead of being mounted from the roof is supported on very rigid rails fitted on the supporting walls of the Tank. For the purpose of securing for photographic and other requirements a light as nearly uniform as is possible, the tank is placed in an approximately north-and-south line and is lighted mainly from the north side by the well-known ridge lights adopted in such cases. For the purpose also of facilitating ordinary visual examination of what is happening when a model is being towed, a sunken pathway has been constructed on each side of the tank so as to bring the eye of an observer, standing in the pathway, very near to the level of the upper surface of the water in the tank.*

The actual working of the Tank since its installation has shown that those engaged in its design and execution did exceedingly well.

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* For those who are desirous of considering various matters of detail in connection with the origin of the structure of the Teddington Tank, reference is made to a Paper by Sir Richard Glazebrook in the Transactions of the Institution of Naval Architects for 1910, and two Papers by Mr. Baker in the same Transactions, Part I. in the volume for 1911, and Part II. in the volume for 1912. The details of these Papers do not fall inside the scope of this article.

The travelling carriage or "truck" is of steel. Since the building of the truck, light aluminium alloys of great strength have become obtainable, and if a new Tank were to be constructed, it would be advisable to make its truck of these alloys so as to admit of more rapid acceleration and deceleration than is possible with the heavier steel truck, and in this manner to obtain with a given Tank a greater effective length for uniform speed than is possible with the heavier steel truck. The truck of the Teddington Tank is actuated by powerful electric motors under control from its platform. All the arrangements work quite well. The rails on which the Truck moves are supported on a very substantial foundation, which can be kept almost exactly horizontal with little trouble, and enable the truck to be run at very uniform rates. The alignment of these rails is carefully tested from time to time. Experience has shown that the rails keep their level and width with great constancy, and that changes take place with extreme slowness.

THE OLYMPIC-HAWKE COLLISION EXPERIMENTS AT THE TANK.

Admiralty work of a Tank character is ordinarily done at Haslar, but when Haslar has been overcrowded with work as it was during the late War, the Admiralty has passed on some of its work to the Teddington Tank. Also on account of the nearness of the Teddington Tank to London and the consequent convenience of access to it by Government officials employed in London, and also its better equipment, many special pieces of work have been assigned by the Government to Teddington. A notable example of this sort occurred in the case of the collision near Spithead between the White Star S.S. Olympic and H.M.S. Hawke. The matter involved in this collision raised many questions of fact not concerning the tank or this chapter. It also involved many others relating to the influence of shallow shelving waters on the navigation of ships, and, in particular, the question of the influence of ships on each other when under way near each other in such waters. Many experiments were made in the Teddington Tank to illustrate the features involved, and most of the experiments were witnessed by the Law Officers of the Crown acting in the interests of the Admiralty. The Admiralty also very generously allowed opposing Counsel to witness these experiments so that the Scientific side of the case should be fully discussed in all its bearings. This side of the case was heard before the late Sir Samuel Evans, in November, 1911. These experiments necessitated the erection in the Tank of a temporary false bottom so as properly to reproduce the circumstances of the Shallow Shelving water in which the two vessels were being navigated at the time of the collision and immediately prior thereto. Similar problems have arisen in the narrow waters connecting the great North American Lakes. Admiral D. W. Taylor of the Washington Tank, who, like Mr. Baker, was trained at the Royal Naval College, at Greenwich, has written a very useful paper on this subject.

War pressure has up to the present prevented this matter being further investigated at Teddington, but it is hoped by the Tank officials that this subject will be taken in hand soon and definite numerical conclusions reached, sufficiently full to be a good guide to those engaged in the navigation of ships under such circumstances, and an equally good guide to those who may be called upon to adjudicate on such matters in the event of collision, grounding, or other disaster arising, and the circumstances involved coming before a Court of Justice.

As further illustrating this matter it may be stated that comparatively recently a case came before the Admiralty Court in which this element of interaction appeared in the pleadings, but in the course of the case the matter was settled on other grounds and the features of interaction were left for future discussion as knowledge of the subject increased.

The Saving resulting from Merchant Ship Model Experiments.

Reverting to what was originally the primary object of Tank investigation, it may be stated that the Teddington Tank has been eminently successful. Taking a typical series of ships ranging from about 2000 to 25,000 tons in displacement, the average percentage of reduction in resistance, with properly designed machinery, propellers, and positions of propellers, was about 8·6 per cent. Two notable cases in this series gave a reduction of 35·2 per cent. in one case and 21·2 per cent. in another case. These of course were abnormal. The designs as submitted were not at all good. All, however, gave some reduction, 3 per cent. being obtained in the lowest case. Having regard to the cost of fuel, even a 3 per cent. saving in it is a matter of great importance, operating as it does throughout the whole life of the ship. There is not only less fuel to be *bought*, but there is less to be *carried*, less to be *handled* both in *shipping* and in *trimming* and taking it to the furnaces on board.

War Work at the Tank.

Apart from this original primary work of the Teddington Tank which has prospered so satisfactorily, there are various other works on which it has been engaged. Several have grown out of the War. The development of forms of hulls of seaplanes which could satisfactorily travel on the water and leave it and then take it safely again on alighting from a flight, was very largely carried out at Teddington. So also was the investigation of the forms of the Coastal Motor Boats with their inclined-stepped (practically flat) bottoms. These, with the seaplanes, did much good in the hunting and destruction of the German submarines. Another good piece of work done at Teddington was the development and improvement of what is known as a "Kite." The "Kite" is a body of **V**-shaped section and 5 to 6 ft. long, constructed of wood, and has the property of moving at a constant depth below the surface of the sea when towed at a constant speed. By virtue of this property the "Kite" becomes available for clearing submarine mines from the space on each side of the towing vessel, as the towing wire attached to the "Kite" engages with the anchor wires of submarine or surface mines and directs the mines away from the towing vessel. By the use of special steel towing cables the anchor wires were cut, and the mines, thus being released, floated to the surface where they were easily destroyed by rifle fire or other means.

A further good piece of work done at Teddington was in the designing of the nets that were used in connection with the suppression of the German Submarine Menace. These nets were of two kinds: one kind being used to indicate to surface craft the *presence* of a submarine and thus give the surface craft an opportunity of destroying it; the other kind of net was one which actually enveloped the submarine, held it fast, and led to its destruction, either by forcing the submarine (if it could) to come to the surface in an immobile condition entangled in the net where it could easily be destroyed, or by forcing the submarine to the bottom where the crew perished. The work of the Tank in both these respects was eminently successful. Some Cinematograph pictures of the action of these nets were made and were used for the instruction of many officers engaged in submarine hunting who could not witness the actual progress of the experiments at the Tank. Good work has also been done to promote improvement in the discharge of Torpedoes from H.M. Ships, and in the design of floating Mines.

The above deals with the main objects of work already accomplished by the Teddington Tank, but the list given is by no means exhaustive. Some work of a Government confidential character has been carried out, and this cannot be otherwise here referred to.

THE FUTURE WORK OF THE TANK.

It now remains to consider the probable work of the Teddington Tank in the immediate future. The term *immediate* future is very advisedly used. Nobody can see very far into the future in this matter any more than in any other. All that can be said is that as, in the past, Tank investigation went beyond its first object of predicting the propulsive forces necessary for actual ships, including the design and the suitable placing of propellers, and soon afterwards went on to deal with the influence of bilge keels, the behaviour of Warships in a seaway when in a damaged condition, and several other matters which were very successfully dealt with, so also we may expect that matters of great importance will arise in the future that will equally well be dealt with by the Tank. One of these matters is probably that of large sailing ships of about 8000 to 10,000 tons displacement. The cost of fuel is now so great and the labour conditions of stoking on board so onerous that shipowners may feel inclined, at any rate as a tentative measure, to construct a large sailing ship of about the displacement mentioned above.

The conditions of propulsion of a sailing ship, limiting the question to the purely water resistance side of the question, are very different to that of a steam ship.

(1) The speed is less. (2) The steam ship proceeds for the most

part in a line with the keel and with the vessel well trimmed as regards starboard and port. (3) The sailing ship proceeds for the most part along a line making an angle with her keel (the Angle of Leeway) and at a varying angle transversely as regards starboard and port, as she heels more or less under the inclining effect of the wind pressure on her sails. (4) In the ordinary sense of the term, the steam vessel makes no leeway. (5) A sailing vessel always makes leeway, and one object of her design is to reduce leeway as much as possible.

These special features of the sailing vessel have not yet been much investigated by Tank methods, but Teddington is taking them up so as to have the information ready by the time it is needed. One object in the investigation of this matter is obviously the discovery of "lines" that are easy of propulsion with the vessel both upright and when inclined a few degrees tranversely under sail pressure, and yet are the best for the reduction of leeway and consistent with the necessary conditions of stability and cargo-carrying capacity. In some cases this problem will be varied by the intention of the shipowner to have a small auxiliary power plant installed in the vessel to propel her, although slowly, in calms, light and adverse winds.

Another item in the immediate future work of the Teddington Tank is the effect of end-on regular waves on the resistance to the propulsion of the ship, and the similar effect when the waves are oblique to the course of the ship. The effect of a "Confused" sea on the resistance to propulsion must come later. It is a matter of commonplace to the masters of steam tramps and some other steam vessels, that although some ships, apparently more or less similar, get on fairly equally in smooth or nearly smooth water, some of them fall hopelessly astern in a seaway. The masters of some of these adversely affected vessels describe the efforts of their ships in traversing a seaway as more or less analogous to that of "Pile Driving." They say in their picturesque language that their vessels are brought up with a "round turn." The Teddington Tank will investigate this matter in the near future and endeavour to find lines consistent with economical propulsion in fairly smooth waters, good sea-going qualities, satisfactory as regards cargo-carrying capacity and yet devoid as far as possible of the "Pile Driving" qualities referred to above. A special wave-creating apparatus has been installed at one end of the tank for the purpose of affording means of efficiently studying this important matter.

Still another matter requiring investigation in the near future is that of the exact numerical effect of skin friction on surfaces of such considerable length as is reached in our mammoth liners and men-of-war. Our existing data are derived from experiments on comparatively short lengths of plank. These data were sufficient during the time ships were only of moderate length, but with the great lengths now being adopted, further experiments are very desirable, and these will be taken in hand as opportunity arises.

Having regard to what has been said above, the following details may be permitted. On the north wall of the Tank is a small marble tablet, on which is inscribed:

> "The William Froude National Tank.
> The Gift of A. F. Yarrow
> for the service of the Nation.
> July 5th, 1911."

In the immediate precincts of the tank are two large excellent portraits, side by side, one of W. Froude, the other of Sir Alfred Yarrow, placed there by the friends of both.

Under the former are inscribed the following words:—

> "WILLIAM FROUDE, LL.D., F.R.S.
>
> 1810 to 1879.
>
> "To whose inventive genius the modern method of testing ship and propeller models, and of investigating many hydrodynamical problems is due.
>
> "This portrait, after hanging in the Admiralty Offices of Sir Nathaniel Barnaby, K.C.B., Sir William White, K.C.B., F.R.S., Sir Philip Watts, K.C.B., F.R.S., and Sir Eustace Tennyson d'Eyncourt, K.C.B., all Directors of Naval Construction, was presented to the William Froude National Tank in 1918 by the last named on behalf of the Royal Corps of Naval Constructors as a mark of their great appreciation of William Froude's work in the study of hydrodynamical problems and in the improvement of Naval Architecture and Marine Propulsion."

Under the portrait of Sir Alfred Yarrow are the following words:—

> "Sir Alfred Fernandez Yarrow, Bart., Shipbuilder and Marine Engineer at Scotstoun on the Clyde.
>
> "Formerly at Poplar on the Thames.
>
> "Sir Alfred generously presented the William Froude National Tank to the Nation, as a mark of his great esteem for William Froude and his work, and as a national means of utilising that work in the investigation of hydrodynamical problems, and of securing improvement in Naval Architecture and Marine Propulsion.
>
> "The Tank commenced its work in July, 1911."
>
> (It is proper to state here that the word "generously" in the above was inserted by Sir Alfred's friends without his knowledge.)

Till very recently, the financing of the National Physical Laboratory, inclusive of the Tank, was undertaken by the Royal Society. The income was derived partly from a small Treasury Grant, partly from fees for work done for private firms, and partly by means of donations from those engaged in such industries as might be benefited by the general work of the Laboratory. As the work of the Laboratory increased this responsibility became so great as to lead to the matter being placed before the Government, who, after full consideration of what was involved, have taken over all financial responsibility for the normal work of the Laboratory, including that of the William Froude National Tank with which, alone, this chapter is concerned. In doing so they have laid it down that work done for the direct benefit of industry must receive substantial support from the industries concerned. On behalf of the Tank, and in accordance with the above ruling, the Council of the Institution of Naval Architects has issued an appeal to the principal firms engaged in shipbuilding and marine engineering, and also to shipowners, for donations for *special* investigations at the Tank for improvement in General Scientific knowledge useful to them in their several spheres. It is hoped that a very liberal response will be given. Contributions received as a result of this appeal will not be used in reduction of Government provision for the Tank, but, on the contrary, in accordance with the Government policy already described, will secure additional Government support for the work of the Tank. Such contributions are administered by an Advisory Committee in conference with the Director of the Laboratory and the Superintendent of the Tank. The constitution of this body is at present as under, from which it will be seen that Science and the industries involved are adequately represented.

It is proper to state here that Sir Joseph Petavel, the present Director of the Laboratory, has taken the same keen interest in the welfare of the Tank as was taken by his predecessor, Sir Richard Glazebrook. The Tank owes much to both these gentlemen.

Director: Sir J. E. Petavel, K.B.E., D.Sc., F.R.S.

Superintendent: G. S. Baker, Esq., O.B.E., late R.C.N.C., M.Inst.N.A., M.N.E. Coast Institution of Engineers and Shipbuilders.

Advisory Committee: Sir W. E. Smith, C.B., Vice-Pres. Inst.N.A., Chairman; Sir W. S. Abell, K.B.E., M.Eng., Mem. Council Inst.N.A.; Sir Kenneth Anderson, K.C.M.G.; Colonel R. E. Crompton, C.B., R.E.; P. D. Ewing, Esq., O.B.E.; R. E. Froude, Esq., C.B., LL.D., F.R.S.; Sir A. B. Kempe, M.A., F.R.S.; J. Foster King, Esq., C.B.E., Vice-Pres. Inst. N.A.; C. Livingston, Esq.; W. J. Luke, Esq., C.B.E., M.Inst. C.E., Mem. Council Inst. N.A.; W. H. Maw, Esq., LL.D., M.Inst. C.E.; *The Hon. Sir C. A. Parsons, K.C.B., F.R.S., Vice-Pres. Inst.N.A., Past Pres. N.E.C. Inst. E. & S.; Prof. J. J. Welch, D.Sc., M.Inst.C.E., Mem. Council Inst. N.A.; Sir A. F. Yarrow, Bart., Vice-Pres. Inst.N.A.

The following Bibliography is appended in order to meet the desires of those who may wish to study the Proceedings of the Tank in their full original published form:—

REPORTS ON EXPERIMENTS WITH MODELS OF SEAPLANE FLOATS AND FLYING BOAT HULLS.

(The number and date appended in each case are the number of report and year published in Report of Advisory Committee for Aeronautics.)

Series 1. Flat plate and toboggan float tests, by G. S. Baker and G. H. Millar (No. 70, Nov., 1912).

Series 2, 3, 4, 5. Single and twin floats, boat and toboggan types, one and two steps, by G. S. Baker and G. H. Millar (No. 98, Nov., 1913, No. 99, March, 1914, and No. 113, July, 1914).

Series 6. Tests with twin floats and tail float on self-trimming gear, by G. S. Baker (No. 165, March, 1915).

Series 7. Flying boat hulls, America and A.D. machine types, by G. S. Baker (No. 166, June, 1915).

Series 8. Effect of beam on America type flying boat hull, by G. S. Baker and G. H. Bottomley (No. 187, Nov., 1915).

Series 9. Transverse stability of flying boat machines—position of wing floats, by Tank Staff (No. 188, Dec., 1915).

Series 10. Tests with twin floats and tail floats, Blackburn and other types, by G. S. Baker and Miss E. M. Keary (No. 189, Jan., 1916).

Series 11 (Parts 1 and 2). Flying boat hulls—variation of loading, flying speed, etc., by G. S. Baker and Miss E. M. Keary (No. 300, Nov., 1916).

(Part 3) Wave formation of flying boat hull, by G. H. Bottomley (No. 365, Nov., 1917).

Series 12. Flying boat hulls—tailless type which resulted in C.E. 1 machine, by G. S. Baker and Miss E. M. Keary (No. 412, April, 1918).

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* Recently retired. Successor not yet appointed.

Series 13. Tests to find suitable float for carrying an aerial target, by G. S. Baker and Miss E. M. Keary (No. 410, March, 1918).

Series 14. Notes on the design of flying boat hulls, by G. S. Baker (No. 437, May, 1918).

Series 16, 17. Comparative tests of flying boats of P5/2 and F and N 4 types, by G. S. Baker and Miss E. M. Keary (No. 472, Sept., 1918, and No. 483, Dec., 1918).

Series 18. Impact of flying boat hull on water, by G. H. Bottomley (No. 583, March, 1919).

Full scale work—Series 1. Experiments on a C.E. 1 machine for comparison with model results, by G. S. Baker and Miss E. M. Keary, Capt. Gundry, R.A.F., and Lieut. Hackforth, R.A.F. (No. 473, Sept., 1918).

LIST OF PUBLISHED PAPERS AND REPORTS ON EXPERIMENTAL WORK CARRIED OUT AT THE TANK SINCE ITS INAUGURATION IN 1911.

The effect of bilge keels on the rolling of lightships, by G. S. Baker (Trans. I.N.A., Vol. 54, 1912). Particular interest attaches to the above Paper, as the work involved was the first done in the Teddington Tank after all trials of a preliminary character had been made and all necessary adjustments and calibrations properly carried out.

Methodical experiments with mercantile ship forms, by G. S. Baker (Trans. I.N.A., Vol. 55, 1913).

Effect of form and size on the resistance of ships, by G. S. Baker and J. L. Kent (Trans. I.N.A., Vol. 55, 1913).

Model experiments on the resistance of mercantile ship forms, by G. S. Baker (Trans. I.N.A., Vol. 56, 1914).

Some notes on the design of floats for hydro-aeroplanes, by G. H. Millar (Trans. I.N.A., Vol. 56, 1914).

Further model experiments on the resistance of mercantile ship forms, and the influence of length and prismatic coefficient on the resistance of ships, by J. L. Kent (Trans. I.N.A., Vol. 56, 1915).

Notes on model experiments, by G. S. Baker (Trans. N.E.C. Inst. of Eng. and Ship, Vol. 32, 1915).

Skin friction resistance and our useful knowledge of the subject, by G. S. Baker (Trans. I.N.A., Vol. 58, 1916).

The immediate commercial advantages of experimental tank tests, by G. S. Baker (Trans. Liverpool Eng. Socy., 1916).

The effect of the longitudinal motion of a ship on its statical transverse stability, by G. S. Baker and Miss E. M. Keary (Trans. I.N.A., Vol. 60, 1918).

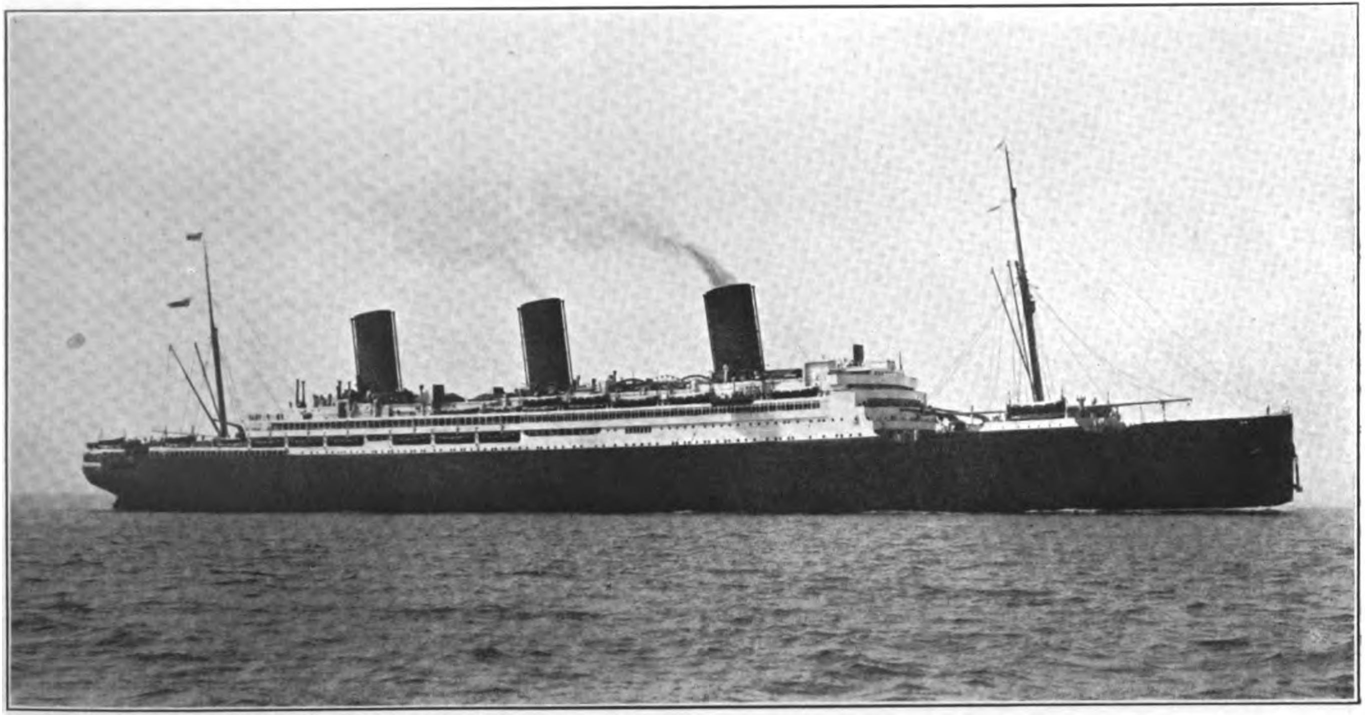
Speed, dimensions and form of cargo vessels, by G. S. Baker and J. L. Kent (Trans. Inst. E. & S. in Scotland, Vol. 62, 1919).

Model experiments on the effect of beam on the resistance of mercantile ship forms, by J. L. Kent (Trans. I.N.A., Vol. 61, 1919).

Model experiments in connection with submarine warfare, by G. S. Baker (Trans. I.N.A., Vol. 62, 1920).

It will be seen from the above that the Staff of the Tank has deserved well of the nation and has made full use of the noble instrument provided by Sir Alfred Yarrow. To those who may desire to follow the working of the Tank in more detail than is given above, attention is called to the published reports of the Advisory Committee.

W. E. SMITH.



(*Photo: Beken & Son, Cowes, I. of W.*)

THE EX-GERMAN LINER IMPERATOR (MANAGED BY THE CUNARD CO.).

(*For particulars see p. 329.*)

CHAPTER V.

Standing of the World's Merchant Fleets.

As a result of the war the balance of economic power as represented by merchant shipping was so seriously disturbed that, after an interval of over two years since the armistice was signed, it has not been completely readjusted. Between the opening of hostilities and its close 15,053,786 gross tons of British and foreign shipping were lost through enemy action and marine risks *—including ships interned in enemy ports (210,653 gross tons)—and of that total 9,031,828 gross tons were British. In other words, the British Mercantile Marine suffered losses 50 per cent. greater than all the Allied and neutral marines combined. The following table reflects these influences of the war by sea upon the world's carrying power:—

British and Foreign Merchant Tonnage Lost through Enemy Action and Marine Risks during the War.

Period.	British.	Foreign.	Total for World.
1914.	gross tons.	gross tons.	gross tons.
August and September .	341,824	85,947	427,771†
4th quarter	154,728	126,688	281,416
1915.			
1st quarter	215,905	104,542	320,447
2nd quarter	223,676	156,743	380,419
3rd quarter	356,659	172,822	529,481
4th quarter	307,139	187,234	494,373
1916.			
1st quarter	325,237	198,958	524,195
2nd quarter	270,690	251,599	522,289
3rd quarter	284,358	307,681	592,039
4th quarter	617,563	541,780	1,159,343
1917.			
1st quarter	911,840	707,533	1,619,373
2nd quarter	1,361,870	875,064	2,236,934
3rd quarter	952.938	541,535	1,494,473
4th quarter	782,889	489,954	1,272,843
1918.			
1st quarter	697,668	445,668	1,143,336
2nd quarter	630,862	331,145	962,007
3rd quarter	512,030	403,483	915,513
October	83,952	93,582	177,534
Totals	9,031,828	6,021,985	15,053,786

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* About 2,000,000 gross tons were lost by marine risks.

† This figure includes 210,653 gross tonnage interned in enemy ports.

The significance of these figures can be adequately appreciated only if they are considered in relation to the British and foreign tonnage which was afloat at the opening of hostilities. The world's total then amounted to 45,404,000 gross tons, of which 20,524,000 gross tons belonged to the British Empire, the Dominions owning 1,326,000 gross tons. The British Mercantile Marine emerged from the war seriously crippled in spite of the new construction in British yards, tonnage purchased abroad, and enemy tonnage captured. On the other hand, the United States and Japan, in particular, increased their sea-carrying power, the Americans becoming at the end of the war the second greatest sea power of the world, judged on the basis of sea-carrying capacity.

With the close of the war, material and labour were set free for making good the depredations due to enemy action, and it soon became apparent that, though the losses suffered by the British Mercantile Marine would speedily be made good, the percentage of world tonnage under the British flag would continue for some years to be considerably smaller than it was in 1914. A survey of the situation at the end of June, 1920, revealed remarkable changes in the relative standing of the great merchant fleets since the war began.

STEAM TONNAGE (MILLIONS OF TONS).

June, 1914.			June, 1920.		
1.	United Kingdom	18·89	1.	United Kingdom	18·11
	British Empire	20·52		British Empire	20·14
2.	Germany	5·13	2.	U.S.A. (seagoing)	12·40
3.	U.S.A. (seagoing)	2·03	3.	Japan	3·00
4.	Norway	1·96	4.	France	2·96
5.	France	1·92	5.	Italy	2·12
6.	Japan	1·71	6.	Norway	1·98
7.	Holland	1·47	7.	Holland	1·77
8.	Italy	1·43	8.	Sweden	1·00
9.	Austria-Hungary	1·05*	9.	Spain	0·94
10.	Sweden	1·01	10.	Denmark	0·72
11.	Spain	0·88	11.	Greece	0·50
12.	Greece	0·82	12.	Brazil	0·47
13.	Denmark	0·77	13.	Germany †	0·42

Germany, from the position of second marine power, has now descended to the thirteenth place. Under the Peace Treaty she surrendered every vessel of 1600 tons and upwards, half the vessels of between 1000 and 1600 tons, and she was called upon to forfeit a considerable proportion of her smaller fishing vessels, with the result that she now possesses less than half a million tons of shipping. Under the Treaty of Versailles she may be called upon to build for the Allies 200,000 tons annually for a period of five years. Austria-Hungary has been left without any shipping, except a few coastal craft of no importance.

* Austria-Hungary has no shipping left.

† Germany now possesses only small ships, all of less than 1600 tons.

LOSSES AND GAINS.

The readjustments in the steam tonnage of the world which took place between June, 1914, and June, 1920, are reflected in full detail in the following table:—

STEAM TONNAGE.

Country.	June, 1914.	June, 1920.	Difference between 1914 and 1920.
	tons gross.	tons gross.	tons gross.
United Kingdom	18,892,000	18,111,000	− 781,000
British Dominions	1,632,000	2,032,000	+ 400,000
	20,524,000	20,143,000	
America (United States)—			
Sea-going	2,027,000	12,406,000	+10,379,000
Great Lakes	2,260,000	2,119,000	− 141,000
Austria-Hungary	1,052,000	Nil	—
Denmark	770,000	719,000	− 51,000
France	1,922,000	2,963,000	+ 1,041,000
Germany	5,135,000	419,000	− 4,716,000
Greece	821,000	497,000	− 324,000
Holland	1,472,000	1,773,000	+ 301,000
Italy	1,430,000	2,118,000	+ 688,000
Japan	1,708,000	2,996,000	+ 1,288,000
Norway	1,957,000	1,980,000	+ 23,000
Spain	884,000	937,000	+ 53,000
Sweden	1,015,000	996,000	− 19,000
Total abroad	26,512,000	35,794,000	+ 9,282,000
World's total	45,404,000	53,905,000	+ 8,501,000

Whereas the British fleet in June, 1920, was still weaker by 781,000 tons than it was on the eve of the war, mercantile shipping abroad, it was revealed, had increased by 9,282,000 gross tons. In issuing the above comparative figures Lloyd's Register remarked:—

> It will be seen that amongst the principal countries, apart from Germany, the United Kingdom and Greece are the only ones which show a considerable reduction in the tonnage now owned as compared with 1914. Notwithstanding the increased construction and the large amount of ex-enemy tonnage provisionally allocated to British management, and of course included in the figures, there are at the present time some 781,000 tons less of steamers owned in the United Kingdom than in 1914 Most of the other countries show an increase, very considerable in some cases. The sea-going tonnage of the United States has increased by nearly 10,400,000 tons, an increase of 500 per cent. on the 1914 figures. The other countries in which the largest increases are recorded are:—Japan, 1,288,000 tons; France, 1,041,000 tons; and Italy, 638,000 tons. As in the case of the United Kingdom, the figures for France and Italy include a considerable amount of ex-enemy tonnage provisionally allocated to these countries. The figures for Germany conclusively show the change in the maritime position of that country. While in 1914 Germany occupied, after the United Kingdom, the first position, with over 5,000,000 tons of merchant steamers, only 419,000 tons are recorded in the book as German, everything else having been either captured, requisitioned, or allocated to the Allies in accordance with the peace treaty. The relative position of some other countries has also altered to a large extent.
>
> In 1914 the United Kingdom owned 41·6 per cent. of the world's steam tonnage, the present percentage is 33·6. . . . Excluding vessels trading on the Great Lakes of North America (about 2,300,000 tons), the United Kingdom percentage of the world's

sea-going steam tonnage has decreased from 43·9 in 1914 to 35·1 in 1920, while the proportion of the United States, which was 4·7 per cent. six years ago, now reaches 24 per cent. It should be stated that, with the exception of the United States, most of the increase recorded by the various countries, as compared with 1914, has taken place during the last twelve months, during which period over 6,000,000 tons of shipping have been added to the World's Merchant Navies. Taken together, the Scandinavian countries—Norway, Sweden, and Denmark—still show a decrease, as compared with 1914, of 47,000 tons.

ACTIVE SHIP CONSTRUCTION.

In June, 1920, a far greater volume of tonnage was under construction in the shipyards of the world than at any previous period, the total amounting to 7,720,904 gross tons, in contrast with the highest pre-war figure of 3,332,882 (1913), but in September the figure had fallen to 7,565,171. Of the total of 7,565,171 gross tons, 3,731,098 gross tons were under construction in the United Kingdom and 3,834,073 gross tons in foreign countries, excluding Germany, for which no accurate information was available. 1,772,193 gross tons were in hand in the United States, of which only 33,709 gross tons were building on the Great Lakes. The other countries showing great activity were Holland with 423,400 gross tons, Italy (including Trieste) with 365,313 gross tons, France with 292,608 gross tons, and Japan with 262,407 gross tons. The British Dominions were responsible for 213,894 gross tons, of which over three-fourths was in hand in Canadian establishments.

There is reason to expect that practically all the tonnage being built in September will be afloat by the end of 1921. This shipbuilding activity will this year synchronise with the weeding out of a considerable number of older ships. The fall of freights during 1920 must result in shipowners scrutinising closely the least efficient vessels with a view to their withdrawal from service at sea. A great deal of the tonnage built under war conditions will also probably be eliminated. This applies, in particular, to a large number of ships under the American flag. The building of oil-burning steamships and motor vessels will also not be without effect in the laying up of the older and less economical of the coal-burning ships.

The movement towards oil as the fuel for marine purposes is revealed in the latest report of the operations of Lloyd's Register of Shipping—1919–20. The following approximate division of shipping classed by Lloyd's, as regards fuel, is given with the figures for the preceding year, indicating the steady increase in the number of oil-burning ships:—

	1919–1920.	1918–1919.
Coal as fuel	76	82
Fitted to use oil fuel for boilers	16·3	10·5
Fitted to use oil in internal combustion engines	1·7	1·5
Sail power only	6	6

In commenting upon these figures Lloyd's Register remarked:—

> Since the armistice a great development has taken place in the use of oil engines. During the year under review classes have been assigned to 28 new vessels of 79,805 tons, fitted with such engines as their main propelling power, 20 of these vessels

having a collective tonnage of 76,993 tons. There are at present in course of construction under the Society's survey upwards of 150 sets of Diesel engines, and about the same number of sets of oil engines of other than the Diesel type, approximately half of which are building in the United Kingdom. In addition, oil engines are being used in large vessels as emergency sets. The largest Diesel engines now being constructed under the Society's survey are those for the Glenogle, a twin screw vessel of 9150 tons, having 16 cylinders, $29\frac{1}{16}$ in. diameter, and stroke $45\frac{3}{16}$ in. The largest oil-engined vessel completed during the year was the Afrika of 8597 tons. This vessel was fitted with Diesel engines having 12 cylinders of $29\frac{1}{16}$ in. diameter and $45\frac{3}{16}$ in. stroke. It may be noted that an increasing number of firms are now manufacturing oil engines, and that some of the engines at present being made are intended for vessels owned by large firms who previously have exclusively used steam engines in their vessels.

The adoption of oil fuel for steam raising and the increasing use of the internal combustion engine promise to produce something in the nature of a revolution in merchant shipping during the next few years. Shipowners throughout the world, anticipating a fall of freights and conscious of the heavy burden of operating charges, including much higher wages for officers and seamen, are exhibiting considerable enterprise in the orders which they are placing for new tonnage. The merchant ships building will undoubtedly prove far more efficient than the vessels now in service. In these circumstances, a great clearance of the lists of older ships and ships built during the war may be expected. The more considerable the fall of freights, the more rapidly will the less efficient ships be withdrawn from service. There is consequently no expectation that the great volume of tonnage now under construction need be regarded as a net addition to the aggregate tonnage of 54,000,000 which was afloat at the end of June, 1920.

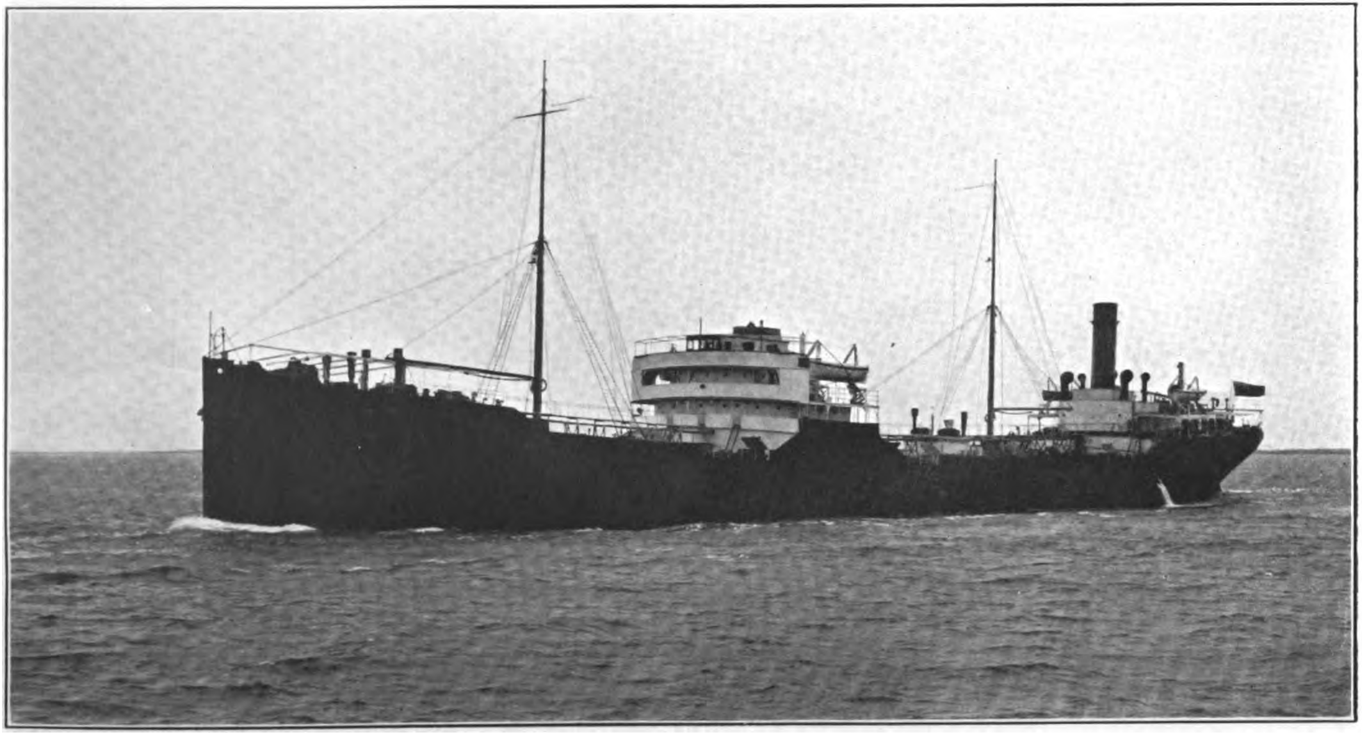
THE EDITORS.

CHAPTER VI.

THE MARINE OIL ENGINE.

As the nineteenth century can well be described as the era of coal, so the twentieth bids fair, so far as marine propulsion is concerned, to be known as the oil age. Gradually, first for special marine duties such as naval work, oil fuel as a substitute for coal has won increasing favour, until at the present time the horse-power of the shipping at sea or in course of construction depending upon oil fuel for the energy of propulsion is a very considerable proportion of the total. The recent conversion from coal to oil firing of the liners Olympic and Aquitania, the great fleet of steam turbine-driven liners building for the Cunard Company with oil-fired boilers, together with the increasing number of Diesel-engined ships in being, such as the Glen Line, and the Oil Tanker fleet building by Messrs. Vickers at Barrow, will be called to mind. Early fears as to the dangers of the use of liquid fuel have proved absolutely groundless provided quite simple precautions are taken. It can now definitely be stated that with all grades of heavy fuel oil on the market, so long as they conform to simple flash-point tests easily carried out by any engineer, oil fuel is quite as safe as coal, and there is as little if not less explosion and fire risk with oil-filled bunkers than may be consequent upon carrying coal with the risks due to coal gases and dust.

The advantages of liquid over solid fuel were early realised, but their force has been intensified many times within the last few years by the general trend of affairs, alike in the labour world as in scientific engineering developments. To take in detail some of the leading characteristics of oil fuel: the cost and difficulty of maintaining a good head of steam with coal-fired boilers have increased at an enormous rate. The quality of coal available has so deteriorated, and the willingness on the part of the men to fire the increased quantity, and to clean fires rapidly and efficiently to keep steam, has lessened, which factors, together with the much greater wages demanded by the necessary labour, have caused many coal-fired steamships to operate during the last few years at much reduced speed and earning capacity. In the case of one Atlantic liner the pre-war speed has been reduced in this way from 18 to little more than 14 knots. At present, oil firing is relatively smokeless, less cleaning of fires and smoke tubes is required, steam can easily be kept, and the total stokehold wages bill is much reduced. Furthermore, the dirt consequent upon coaling ship is absent, the time required for re-fuelling is a fraction of that with coal. The steam-



THE MOTOR OIL-TANKER NARRAGANSETT OF THE ANGLO-AMERICAN OIL CO.

Built and fitted with Diesel engines by Messrs. Vickers, Ltd., Barrow-in-Furness.

raising qualities of oil fuel per ton average some 40 per cent. more than in the case of coal, and are about half as much again as coal for equal cubic contents of bunker capacity. These savings translated into pounds sterling are referred to later in detail when dealing with oil engines. See the following table:—

TABLE OF COMPARISON OF STEAM AND OIL-ENGINED VESSELS.

Type of Propelling Machinery.	Diesel Engines.	Reciprocating Steam-Engines.		
	4-cycle single-acting reversible, crosshead steam-driven auxiliaries.	Triple Expansion Engines. Cylindrical Boilers. Howden's Forced Draught. Superheat 50° Fahr.		Turbines with Redn. Gearing oil fired. 150° Superheat.
		Coal-Fired Boilers.	*Oil-Fired Boilers.*	
Total deadweight in tons	10,050	10,230	10,235	10,235
Freight-earning cargo in tons	9,357	7,880	8,555	8,743
Average Sea Power. Horse-Power . . .	2,500 (Shaft)	2,800 (Indicated)	2,800 (Indicated)	2,500 (Shaft)
Radius of action in miles	10,500	10,500	10,500	10,500
Fuel Consumption per Brake Horse-Power hour, including Auxiliaries in lb.	·55 estimated	2·0	1·4	1·1
* Fuel Consumption per day in Tons . . .	14·7	53·5	37·5	29·5
Fuel Consumption per voyage of 16 days in Tons	235	855	600	472
COMPARATIVE COSTS OF WORKING.				
Provisions, total per month	£251 5*s*. 0*d*.	£308 5*s*. 0*d*.	£260 5*s*. 0*d*.	£260 5*s*. 0*d*.
Wages, total per month .	£631 10*s*. 0*d*.	£733 10*s*. 0*d*.	£637 10*s*. 0*d*.	£637 10*s*. 0*d*.
Fuel, per 16 days' sailing	£2,704 (£11 10*s*. 0*d*. per ton)	£4,500 (£5 5*s*. 0*d*. per ton)	£6,223 (£10 7*s*. 6*d*. per ton)	£4,900 (£10 7*s*. 6*d*. per ton)
Fuel, per month of 24 days' sailing . . .	£4,056	£6,750	£9,334	£7,345
Cost of running for one year of 288 days' sailing	£76,536	£108,504	£137,764	£98,913
Tons of freight-earning cargo carried, assuming 9 round voyages per year, each of 32 days' total sailing out and home	168,426	141,840	153,990	157,274
Cost per ton of cargo carried per 16 days' sailing out and home .	9*s*. 1*d*.	15*s*. 4*d*.	17*s*. 11*d*.	12*s*. 6*d*.
Cost per ton-mile . .	·027*d*.	·045*d*.	·053*d*.	·0371*d*.

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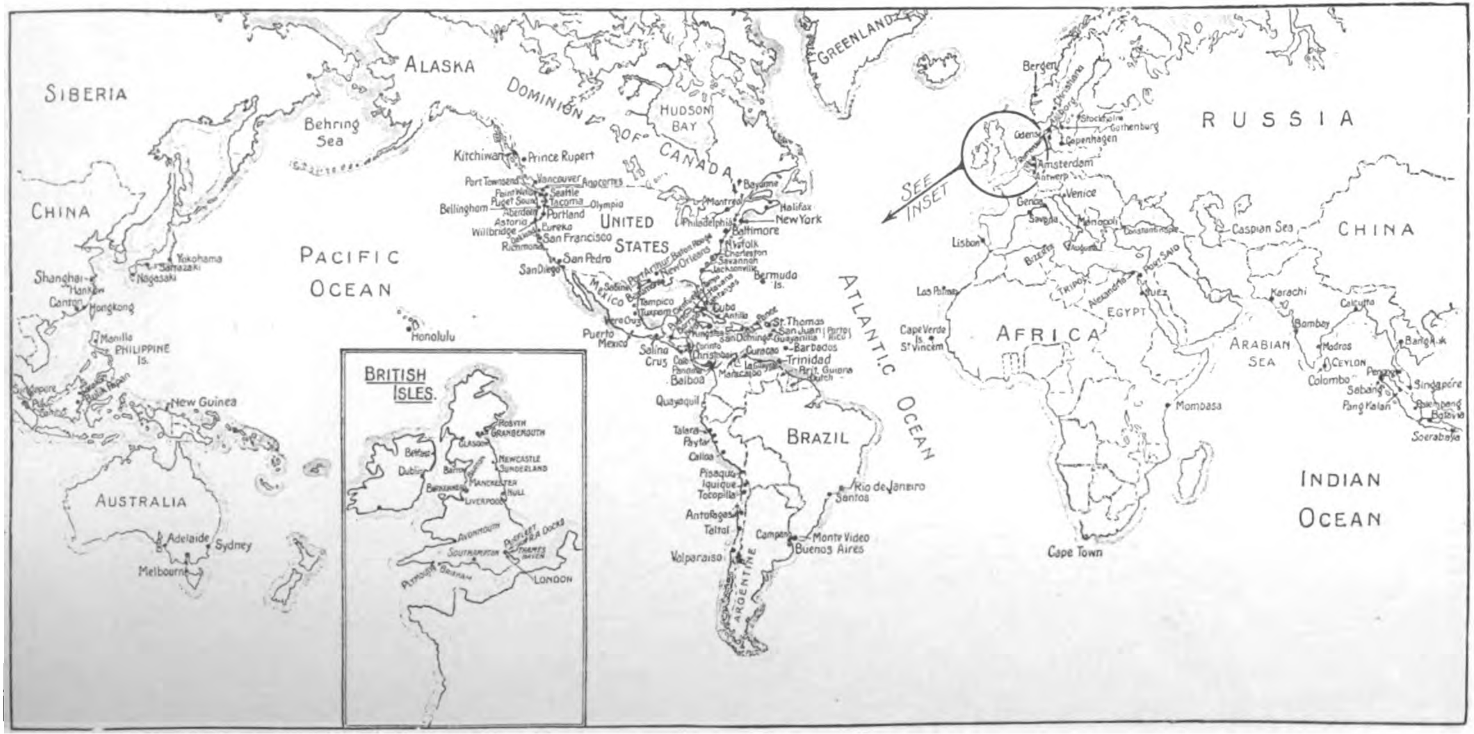
* Calorific value of oil fuel taken at 19,000 B.T.U.'s. Calorific value of coal taken at 13,500 B.T.U.'s.



PORTS WHERE OIL STORAGE IS PROVIDED.

(*Reprinted from "The Motor Ship."*)

ECONOMIC FACTORS.

So much by way of general advantages. There remains the question of supply, distribution, and price. The price of coal within the last five years has risen much more rapidly than that of oil, due, in measure, to the great oil fields of the world being largely unaffected by the war. Shortages have been felt in the supply of oil within the last few months, but these have largely been the effect of the great reduction in oil stocks, owing to the demands of the navies of the Allies and the fighting forces, and to the most severe shortage of tank ships to transport the oil. Many, however, of these vessels are at present being built and a number more are still required. This construction will tend to effect an improvement alike in price, regularity of supply, and completeness of distribution of liquid fuel. Authorities differ as to the amount of the world's future supply, and on an assumption of increasing requirements the balance between supply and demand is questioned, but all are agreed upon the absolute and fundamental necessity of using such supplies as are available with the maximum economy. The chart on the opposite page shows that the distribution to-day fairly well covers the principal ports. With increasing tonnage of tankers available and the maintenance by the great oil companies of the same broad and enterprising policy as in the past, this aspect of the question should not give rise to fears that future arrangements will be inadequate to the demand.

In dealing with the marine oil engine the leading theme might well be the most economical utilisation of the world's oil resources. The principle of internal combustion confers advantages of running economy as represented by power given out at the propeller per ton of fuel, or in terms of ton miles per ton of fuel consumed, much greater than any other system. This is only natural, since, instead of the heat of combustion of the oil fuel or coal being used to convert water into high-pressure steam, which in turn does work by expansion in the reciprocating or turbine steam engine, with the oil engine, the oil is used in the engine cylinder itself, and the energy of combustion heats the air in the cylinder, expands it, and so performs the work directly upon the piston without any conversions of energy. This great step forward of dispensing with steam as a medium for conveying the energy of the fuel from the combustion apparatus to the propeller results in unique economies. Steam, as such a power-conveying means, is relatively inefficient in spite of all the splendid work done in the various phases of energy transformation in a steam plant—combustion, steam generation, expansion, condensation at high vacua, etc.—although on the other side of the balance-sheet it must be stated that the available power in the steam can readily be harnessed to do useful work demanding only a fraction of the mechanical ingenuity and application of scientific structural design and construction required to produce a successful marine oil engine.

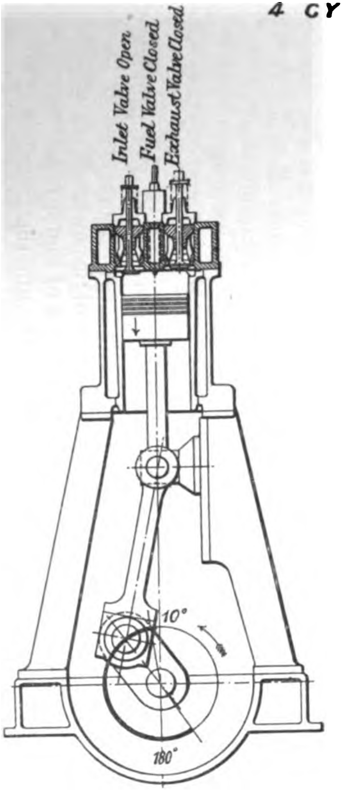
PRINCIPLES OF THE DIESEL TYPE.

It would be well, perhaps, at this stage briefly to describe the leading principles upon which the Diesel type of oil engine works. As shown in the diagram on p. 187, during the first stroke of the cycle (the down stroke of the piston) pure air is drawn into the cylinder through the inlet valve in the cylinder head. At approximately the bottom of the stroke this valve is closed and the upward-moving piston, completing the first revolution, compresses this air, trapped within the cylinder, to a sufficient pressure and consequent temperature to ignite the oil which is injected at or about the top of the stroke. This oil on ignition and combustion heats up the air within the cylinder, which on the third stroke (the downward stroke of the piston) expands and does work. The fourth stroke of the cycle (the upward stroke of the piston) serves to expel the exhaust gases through the exhaust valve in the cylinder head. This, then, briefly, is the standard cycle of operation. Modification, whereby the same functions are performed in two strokes or one revolution, as against four strokes or two revolutions, known as the 2-stroke cycle principle, requires certain structural alterations. The reduction from four strokes to two strokes is effected by arranging for the exhausting of the charge at the end of the power stroke and the refilling of the cylinder with fresh air for the new cycle at the beginning of the compression stroke. This exhausting and recharging is carried out by means of introducing ports in the cylinder liner, which are uncovered by the main piston at the end of the stroke, instead of by mechanically operated valves in the cylinder head.

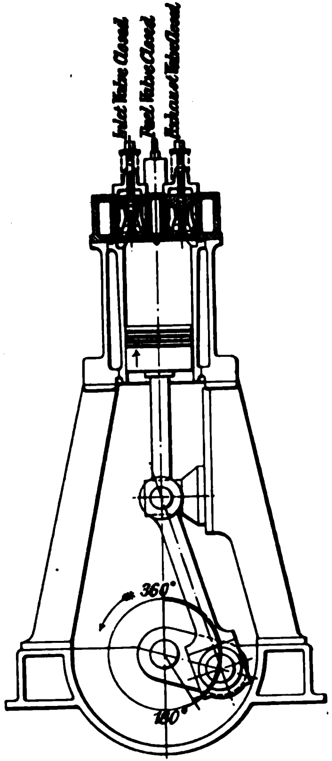
It must be recorded that very considerable troubles have been experienced with some of the earlier Diesel oil engine installations, and it will serve as guidance for those at present considering the adoption of this means of propulsion briefly to discuss some of the leading causes of unreliability at sea. Generally, in the early stages of development, the 2-cycle principle was preferred for reasons that seemed good and substantial to those marine engineers whose dealings had been primarily concerned with the steam engine, but which carry relatively little weight where the entirely new principle of internal combustion is involved. In particular, we would refer to the claims of lighter weight, smaller space occupied, and more even turning moment which led to the installation of large 2-stroke cycle Diesel engines before sufficient experience or knowledge was available of this type of prime mover, either on land or at sea.

The 2-stroke cycle, as already described, requires the dissipation per unit area of combustion chamber volume, of greater quantities of heat than the 4-stroke cycle in proportion to the gain in power per unit volume of cylinder with the 2-cycle. The heat stresses set up in this way with the 2-cycle principle are greater than with the 4-cycle, and the extra difficulties so involved in securing suitable castings for the main parts were not realised in the early days of the development. Furthermore, early constructors of Diesel engines with a successful record of performance with land installations were led somewhat hastily to enter the marine field without fully

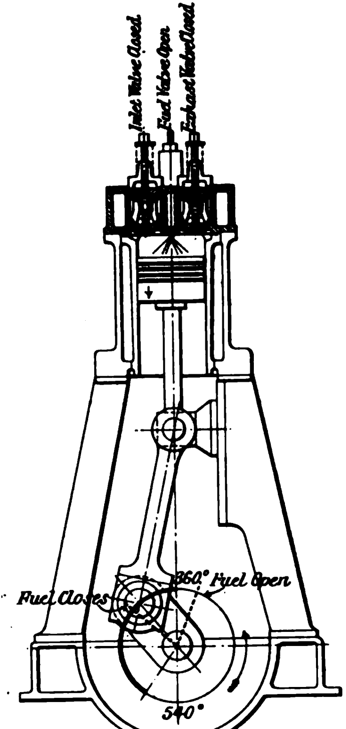
4 CYCLE DIESEL ENGINE: DIAGRAM OF OPERATIONS



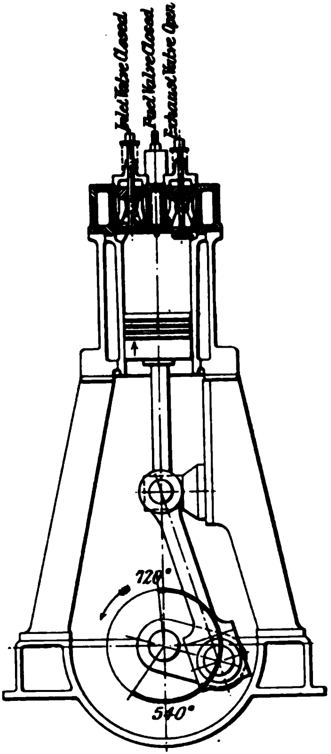
INDUCTION
Inlet Valve Opens - 10°
" " Closes - 210°



COMPRESSION



FIRING
Fuel Valve Opens - 340°
" " Closes - 410°



EXHAUST
Exhaust Valve Opens - 505°
" " Closes - 725°

appreciating all the necessary conditions which a successful marine engine must fulfil. Considerable progress, however, has been made since these early installations were first put to sea, and while, during the war, mercantile marine engineering concentrated on that type of prime mover which presented the fewest problems—the triple expansion steam engine—yet much experience in Diesel submarine work was gained, is now available, and in due course will be applied to mercantile construction.

DIFFICULTIES OVERCOME.

In particular, it is now generally realised that to operate a marine Diesel engine successfully, it must be rated for continuous full power work at a definite and reasonably low fraction of the maximum power which can be sustained on the test-bed in the makers' shops. To give a figure for this percentage to cover all cases is impossible, but as a guide 85 per cent. for 4-cycle engines and 75 per cent. with the 2-cycle principle will be somewhere near the mark. To no one cause can so much disappointment with internal combustion engines be traced, as to overloading. The temptation to reduce weight, space occupied, and cost, by anticipating the successful operation of an oil engine at a relatively high power, mean effective pressure in the cylinders, and consequent high heat stresses, in the metal surrounding the combustion chamber, is very considerable, but must sternly be resisted by the engineer. Inducements to neglect this precaution will be considerably less frequent when the foregoing fundamental characteristic of the Diesel engine is more fully and widely appreciated by shipowners, their representatives, and advisers.

The injection of the fuel into the working cylinder calls for a mechanism to raise the fuel to the requisite pressure to ensure entrance into the cylinders, to measure the exact quantity to give the power desired, and to control the time and period of injection suitably to give satisfactory combustion, that can only be described as delicate. The necessary adjustments to counteract any defect can be readily carried out with all modern designs, provided they are undertaken in time. Increasing experience of those responsible for the operation of such plant gives greater reliability in this respect. For injecting the fuel, compressed air supplied by a multi-stage (almost always now a 3-stage compressor) is used, and the problems of compressor design are now treated with the consideration deserved, and not relegated to an unimportant position. Systems of injection of the fuel without the aid of compressed air have been developed to a high degree, and are incorporated with certain designs, offering an alternative arrangement.

As with all engineering, the metallurgical side of the problem is being more gradually realised as not the least important, and it is increasingly clear that the future of the high-powered oil engine is bound up as much with the regular supply of high-grade materials as with any question of design proper. Within the last few years, much earnest research work has been undertaken, and when in time the results and discoveries of such investigations can be translated into practical politics in the foundry, progress will undoubtedly be more rapid and sure.

OIL ENGINES FOR CARGO SHIPS.

At the present time there are being built some 200 vessels of 3000 tons deadwight capacity and over, to be equipped with Diesel engines, and of these the 4-stroke cycle strongly predominates. The position at the present time is such that marine Diesel oil engines are now available for the majority of cargo ships. For small powers, the semi-Diesel engine, in almost all cases in the simplest forms with trunk pistons instead of crossheads, is being extensively adopted. Such engines are, of course, not such a sound marine proposition as the average crosshead engine, but for the smaller ships, where engines of not more than 500 B.H.P. are required, they meet the present demand. As to the limiting size of the Diesel engine no definite statement can yet be made. The largest cylinder at sea gives some 300 B.H.P., or with twelve such cylinders a total of 3600 B.H.P.; with 16 units the power becomes 4800 B.H.P., which, with twin screws, is equivalent to steam machinery of 5000 to 6000 indicated horse-power. Experimental cylinders of very much larger power than this have, of course, been built, but are not yet sufficiently developed to be put forward as multi-cylinder units for marine work, however well they have served for elucidating the important problems connected with marine oil engine design.

In view, however, of the advantages of the economical utilisation of oil fuel possible by the adoption of Diesel engines, it can only be regarded as a matter for surprise that the Diesel engine is not more generally being adopted at the present time than is the case. The main reasons for the delay in the adoption of the oil engine may be stated to be the following: 1. Satisfaction with the past earnings of ships with relatively uneconomical steam plant. 2. Difficulty with oil fuel either due to "cornering" or through the lack of suitable fuel facilities. 3. High first cost, or doubt as to the reliability of this new prime mover.

Whilst the average steam-engined ship has met the needs of the past, the time is undoubtedly fast arriving when only the most economical principles from the propulsive point of view can be surely successful in showing a requisite margin of profit, and this definite statement demands that shipowners should most seriously consider the adoption of the Diesel oil engine. The fact that with the oil-engined ship alone can the difficult firemen class be abolished gives it a most substantial advantage.

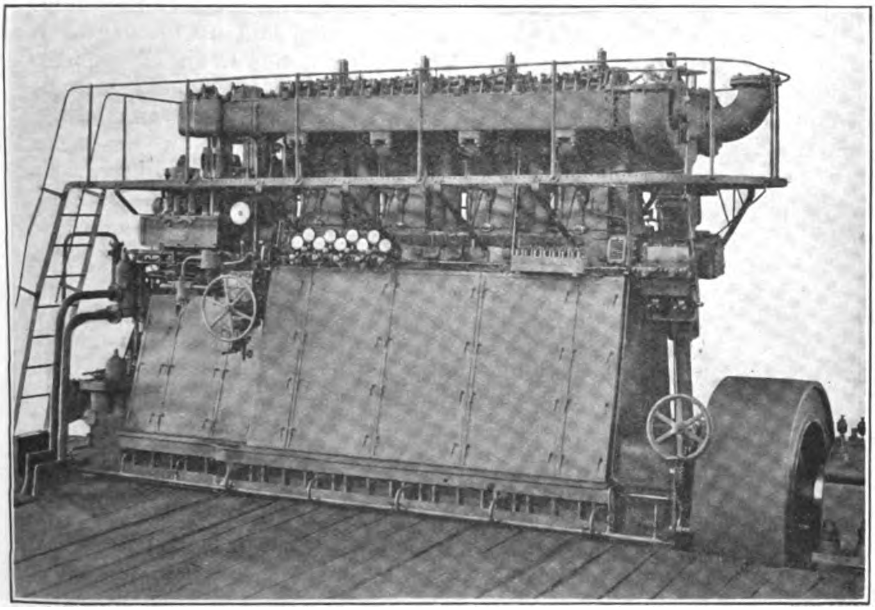
Owners of converted oil-fired steamers are already experiencing trouble from the Firemen's Union, who, apprehensive of the results consequent upon the reduction in crew possible with oil fuel fired boilers, seek to keep the stokehold personnel at a higher figure than is necessary for safe and satisfactory operation of the plant.

HIGH FIRST COST.

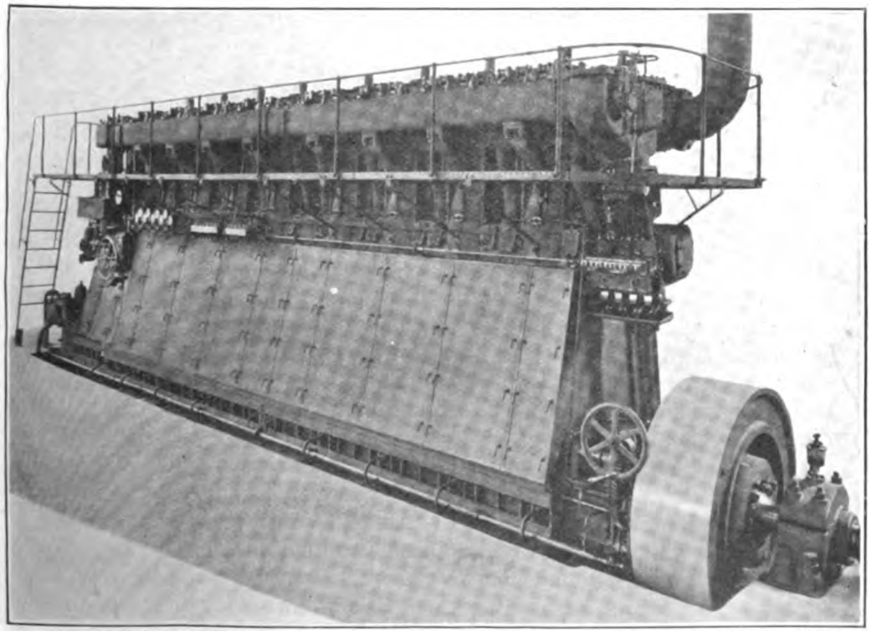
The next point—the high first cost—must be conceded as an argument against the Diesel oil engine. Even when the full advantages of rigid standardisation and the possibility with this type of prime mover of constructing engines of different powers and numbers of cylinders to meet the various horse-powers required by different classes of vessels are fully realised in practice, the fact remains that the type of machinery must be of such high-grade materials and workmanship as to be considerably more expensive in first cost for a given power output than the average steam plant. As an interesting and unique example of what can be achieved commercially by a series of engines for mercantile propulsion, the illustrations on p. 191 show two engines, respectively of 400 and 800 B.H.P. of a series of three engines of 4, 6, and 8 cylinders, each composed of the same unit cylinders of 100 B.H.P. In the case of the 4-cylinder engine, the starting arrangements are somewhat different from those adopted with the 8-cylinders, in order to ensure immediate starting from any crank angle position of rest. These engines develop full power at from 160–175 r.p.m., and are identical in design and construction, with the exception only in regard to the starting mechanism. As to the savings effected this will be later dealt with in some detail. As an offset against the extra first cost of the machinery the saving in fuel must be considered.

In order to give a definite idea on the subject of extra first cost it may be stated that a 10,000 tons capacity, 11-knot oil tanker costs, if fitted with single screw steam engines, approximately 10 per cent. less than does a ship of the same capacity fitted with twin screw oil engines. In a number of cases, however, this 10 per cent. may be reduced owing to the fact that the fitting of oil engines reduces the weight and space occupied by the machinery, and so permits of a larger earning capacity from the same size of hull or alternatively of a smaller ship being able to perform the same duties. The main point, however, is reliability of operation in service at sea.

Reference should be made to the large fleets owned by a number of successful shipping companies, for instance, the Anglo-Saxon Petroleum Company, whose first single screw motor ship Vulcanas has been running successfully since 1910, which up to a recent date had logged over one quarter of a million nautical miles with an average speed of 7 knots, the full speed of the ship being 8 knots. Another fleet of Diesel ships is that of the East Asiatic Company, and of later date the "Glen" Line. In connection with the former their first Diesel ship, the Selandia, placed on service early in 1912, has logged 327,730 nautical miles at an average speed of 10·74 knots. The Trefoil, a Vickers-built solid injection Diesel-engined tanker, was attending "at an hour's notice" on the British Fleet during the war, and for eighteen months no opportunity was given for examining the main Diesel machinery. During this time only one exhaust valve was opened up for the spindle to be eased, and during one quarter she was under way for no less than seventy-eight complete days. At



TOSI FOUR-CYLINDER FOUR-CYCLE MARINE OIL ENGINE.



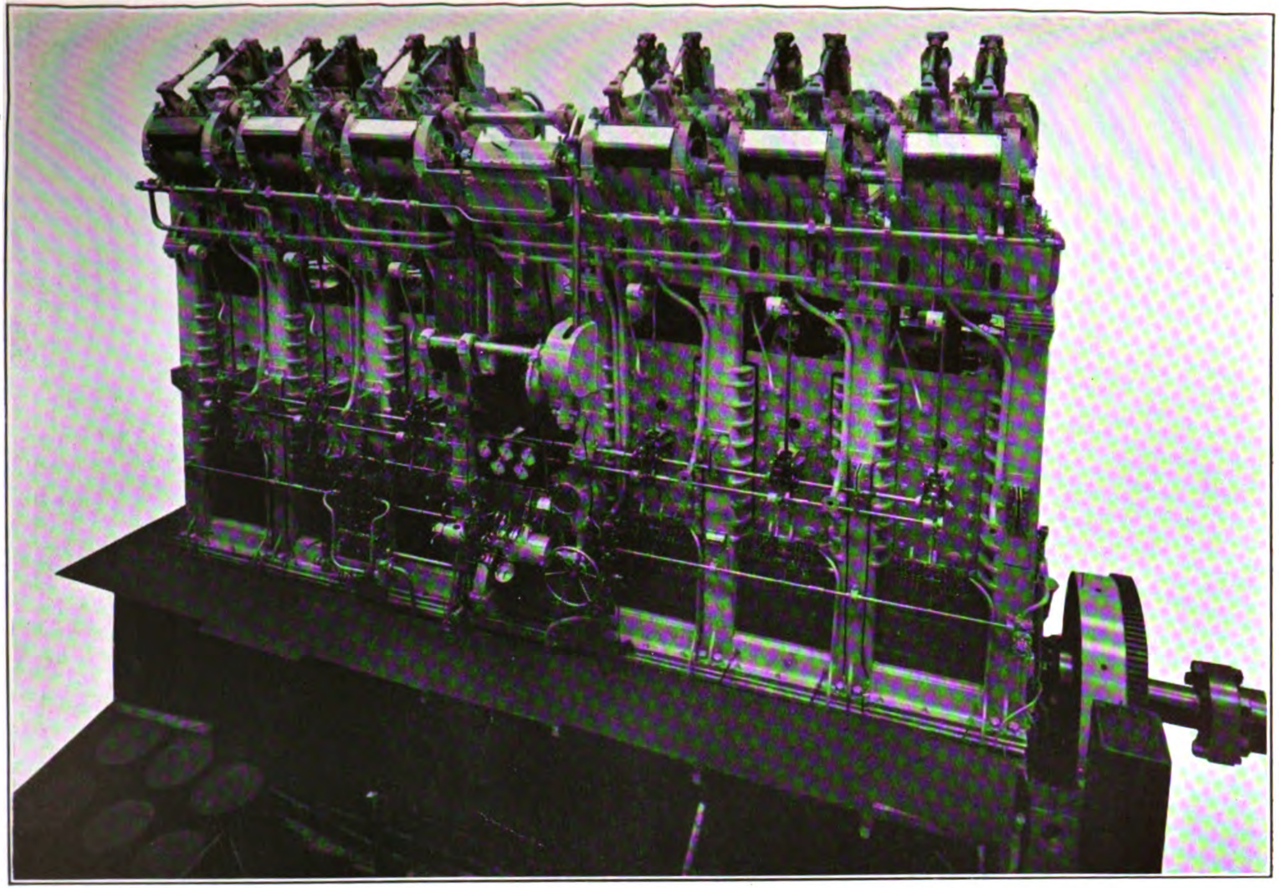
TOSI EIGHT-CYLINDER FOUR-CYCLE MARINE OIL ENGINE.

the end of eighteen months her oil engines were reported as running like clockwork, but the ship had then to be laid up for overhaul of her steam auxiliary plant. The Marshal Soult, an oil-engined monitor, was in action against the forts on the Belgian Coast from November, 1915, to 1918, during which time her main circulating water inlets were often deep in the mud of this shallow sea-coast, yet every order from the bridge was obeyed, and her machinery was examined or cleaned only during such times as the ship was laid off for other purposes. Moreover, the records of the submarines propelled by Diesel engines in the various navies during the great war should go a considerable way to discount any fears as regards the reliability of such machinery. These few examples are given more or less at random and are commended earnestly to the attention of shipowners.

Economies from Oil Fuel.

The economies effected by the installation of Diesel engines are so great that it is well to make a considerable point of the fact that any boiler fuel is not necessarily the most suitable from all points of view for marine oil engines. It is often decidedly economical to purchase a higher grade of oil at an enhanced cost per ton if by so doing the amount of periodic attention and cleaning required by the valves and other parts of the mechanism is substantially reduced, and in the tables on p. 183 this point has fully been legislated for in that the price of oil per ton has been stated at a higher figure than for steam plant. The figures taken in the subsequent tables for fuel consumption in regard to the Diesel oil engine are conservative, as is proved by the Anglo-American tanker the Narragansett of 10,000 tons deadweight, which on a seventeen-days' return voyage from her maiden trip to New Orleans had a total daily consumption of 11·74 tons at a speed of approximately 11·1 knots. The average consumption of seven steamers of approximately the same deadweight with oil-fired boilers was 35 tons of oil fuel at a speed of only 10·25 knots. A steamer with coal-fired boilers of a very slightly greater deadweight of 10,400 tons burnt 55·8 tons of coal per day at 9·8 knots. The ratio of consumption of these ships is therefore: Oil engines 1, oil-fired boilers triple expansion steam engines 2·98, coal-fired boilers triple expansion steam engines 4·75, whilst the figures taken in the tables are respectively, 1, 2·55, and 3·64. The lower speed of the steamers is further to their disadvantage.

This table of steam and oil-engined vessels is generally self-explanatory, and has been made out to cover for an average case. Where possible, the oil ships will take on fuel at ports where the price is low, and especially with Diesel-engined vessels the capacity of the bunkers may well be so increased as very appreciably to augment the radius of action, and with a corresponding improvement in the saving due to cost of fuel and bunkering. Furthermore, the figure of 0·55 lb. per B.H.P. per hour given for the 4-cycle Diesel engine is distinctly high. It applies, however, in



STARBOARD MAIN OIL ENGINE (VICKERS' SOLID-INJECTION SYSTEM) FOR MOTOR SHIP NARRAGANSETT.

general to such cases as 2-cycle main engines with steam-driven auxiliaries, or for 4-cycle machinery similarly equipped, but with the type of plant, familiarised by the large fleets of the East Asiatic Company and the Glen Line, where all the auxiliaries, including deck winches, steering gear, capstan, etc., are driven by electric motors supplied with current from Diesel-driven dynamos, the figure of 0·55 becomes 0·45 lb. per B.H.P per hour for all purposes with the corresponding saving per annum for fuel.

A very natural question may be asked, as to whether this consumption can be maintained over a period of years of normal service, and emphatically an affirmative answer can be given. Whereas with steam installations the fuel consumption is liable to substantial increases consequent upon fouling of the internal heating surfaces of the boilers, sooting up of the tubes, deterioration in the condenser, leaky glands and valves, erosion in turbine nozzles, increased tip leakage of blades, and many other causes, the Diesel engine presents no parallel.

Piston rings and valves with this latest prime mover must be kept clean and tight for safe operation, and with reasonable periodic inspection, cleaning, and grinding, the economy is in no way impaired even after years of service. This periodic inspection is necessary apart from considerations of economy of fuel consumption, and can be reduced by running the engine at a moderate rating of power, using a fair quality of fuel oil and with intelligent operation. The Diesel ship will sail at a higher average speed due to being immune from questions of boiler condition and operation.

On a conservative basis, however, the Diesel ship shows a saving in cost per ton-mile of nearly 70 per cent. over the coal-fired steamer, and 90 per cent. over the oil-fired steamer equipped with triple-expansion steam engines, and 50° F. superheat. As compared with turbines and reduction gear, oil-fired boilers of 150° F. superheat, the saving is 35 per cent.

JAMES RICHARDSON.

CHAPTER VII.

AMERICAN SHIPBUILDING DURING THE WAR.

THE progress of the war made it clear to the people of the United States that the main struggle between the Allies and the enemy depended upon the result of the submarine warfare pursued on defenceless merchantmen at sea, and efforts had already been made to help, as far as the limits of neutrality permitted, to maintain the seagoing tonnage of the world which was shrinking and which was subject to a gradually increasing demand owing to the commitments of the Allies to oversea operations. When, therefore, the United States came into the war, they were well aware that one phase of their great work would have to be the production of merchant ships—firstly, so that more ships could be put afloat than the submarines could sink; and secondly, because their participation in the land war in Europe was only possible by the production of ships, more ships, and yet more ships.

The magnitude of the effort they made has not yet been properly appreciated, nor is it commonly known that their work from April, 1917 to the end of 1918 made it apparent to the Allies that their combined output of ships for 1918 would certainly exceed the probable rate of destruction by enemy submarines.

We have to go back in the world's history a long way to find an instance of ship production at all comparable in magnitude to the numbers of vessels produced by the Americans after their entry into the war, for in 1918 the United States built 821 seagoing vessels in addition to 1060 non-seagoing craft and a considerable number of small fighting ships and naval auxiliaries. It was in fact as long ago as 261 B.C. that the Romans in the first Punic war with Carthage realised that if they were to deal effectively with the occupation of the Mediterranean and the Islands adjacent to Italy, it would be necessary for them to take to the sea. So during that year they built within two months 100 quinqueremes, large galleys with five tiers of oars, and thirty triremes with only three banks of oars. They defeated the Carthaginians at sea in the great battle of Ecnomus (256 B.C.), when, perhaps, some 700 to 800 vessels were engaged. Later, they lost a number of ships in a storm and replaced their fleet with 220 new vessels within three months. The year 249 B.C. was rather diastrous to the Romans, for they lost 180 vessels in battle at Drepanum and, in addition, some 120 vessels and 800 transports were sunk by raiders and stress of weather. The war pursued a desultory course for another seven years, but the Romans made a final effort in which they built a further war fleet of 200 ships, and defeated the Carthaginians finally at the Ægulian Isles in 241 B.C., thus terminating the war.

THE AMERICAN SHIPBUILDING INDUSTRY.

It is necessary to remember that prior to 1914 the output of the United States shipbuilding yards was very small in comparison with that of the rest of the world, for in the record year—1913—when the world built about 3,300,000 gross tons of shipping, the production of oversea tonnage in the American coast establishments was barely 230,000 gross tons, or some 7 per cent. of the world's total. It is certainly true that on the Great Lakes there were shipbuilding establishments which had perhaps a capacity equal to that of the coast yards, but in these districts the ships produced were of a very special character, suitable only for the purposes of transportation on the Great Lakes, and no seagoing vessels of any importance had hitherto been built there. This is probably due to the fact that, as access to the sea was only obtainable through canals, the dimensions of seagoing vessels built on the Lakes were practically confined to vessels of about 250 ft. in length and 3500 tons deadweight, a type which was much smaller in size than that of the average oversea merchantman. It may be said, therefore, that the potential shipbuilding capacity of the United States in pre-war days might have amounted to as much as 500,000 gross tons, of which about half was situated on the Atlantic and Pacific coasts, the remainder being adapted for the production of small seagoing steamers on the Great Lakes. As an illustration of the maximum output, it may be mentioned that in 1907 the coast shipyards produced 170,000 gross tons, and the Great Lakes district 260,000 tons, while 60,000 tons of wood vessels were produced, making a total of 490,000 gross tons. Owing to the demands for shipping by neutral countries and by Great Britain, the output was slowly increased during the earlier years of the war. In 1916, about the same total of shipping was produced as in 1907, with this striking difference, that the coast yards had reached an output of 330,000 gross tons, while the Great Lakes had fallen off to 120,000 tons, probably owing to the decrease in demand for Lake steamers.

With the entry of the United States into the war, strenuous efforts were made in every direction to increase production, and after a considerable amount of discussion and changes of directorate, the policy tended to shape itself somewhere about the middle of 1917 into the following phases:—

(1) Extension of existing shipyards and provision of additional labour. Some of the bigger shipyards, notably the Union Iron Works, worked three shifts a day, of eight hours each, including Sundays and holidays.

(2) The provision of new shipyards, which sprang up in every direction.

(3) The production of a series of special designs, few in number and of simplified construction, which were ordered in

batches in such a manner as to suit the capacity of various shipyards.

(4) The introduction of fabricated ships whereby use was made of the plant and labour available in the bridge-building and structural steel establishments to prepare material which was put together in special shipyards—hence fabricated ships.

(5) The initiation of a huge wood shipbuilding programme, the intention being to use the wooden ships to replace steel steamers in the coasting and domestic service, and set the latter free for oversea work.

(6) The transfer of the Great Lakes shipbuilding establishments to the construction of small ocean-going steamers, for which a special design was prepared.

(7) The introduction of concrete shipbuilding, which was only pursued to a comparatively small extent.

The Great War Programme.

A huge department under the title of the Emergency Fleet Corporation was formed to direct these operations, and altogether, according to its original programme, it placed contracts for 1727 steel vessels, 1017 wood vessels, 50 composite vessels, and 43 concrete ships, aggregating a total deadweight tonnage of nearly 15,300,000 tons, equivalent to about 10,000,000 gross tons. The Corporation provided help of all kinds, including financial assistance, and by the end of 1919 Congress had appropriated over 3,100,000,000 dollars to the credit of the Emergency Fleet Corporation and the associated authority, the United States Shipping Board.

The construction of the fabricated vessels, which involved a very great amount of organisation, was placed in the hands of three agencies, viz. The American International Shipbuilding Corporation, which undertook the construction of the famous Hog Island shipyard; the Submarine Boat Corporation of New York, which directed the yard at Newark, New Jersey; and the Merchant Shipbuilding Corporation with its yard at Philadelphia.

The construction of the Hog Island yard is one of the most remarkable achievements ever recorded, for on September 13, 1917, Hog Island was 856 acres of swampy marsh situated eight miles from Philadelphia and without any railroad facilities; yet in this shipyard of fifty ways the first keel was laid on February 12, 1918, and at the expiration of a year the erection of the first fifty vessels had been begun. The building of this establishment took place during one of the worst winters ever known. For two or three months the whole site was under arctic conditions, and steam had to be constantly used to thaw out the ground before work could be proceeded with, to say nothing of the difficulties of using concrete in such weather. It is true to say that within twelve months there was built a complete industrial city, employing some 30,000 workmen; this city was supplied by two trunk lines of railways, and it was estimated that the shipyards were capable of delivering about 100 complete vessels a year under favourable conditions. As a matter of history, bearing in mind always that the Armistice prevented the proper fulfilment of performance, the first two vessels were launched in August, 1918, while the total for the year was twelve vessels launched. The total work done in 1918 was equivalent to the completion of about thirty vessels of 8800 tons deadweight. As was only to be expected with the earlier vessels, some delay occurred in fitting out the machinery, but by the end of January, 1919, five vessels were already on service. Judging from the best performances, it would appear that the rate of output that Hog Island reached at the beginning of 1919 was about seventy-eight vessels a year, or one and a half a week, and this, bearing in mind that the output anticipated was only about two vessels a week, is no mean achievement, particularly when the nature and quality of the labour available is taken into consideration. The men employed in Hog Island were taken from every kind of occupation, and nearly the whole of them, apart from the general direction, had no previous experience of shipbuilding or marine engineering; all had to pass through a special school of intensive instruction, which was set up for that purpose.

The supply of fabricated material in itself was a great task, for the material was made at thirty-eight distinct steel works, passed through the hands of eighty-eight different firms of fabricators, who shaped and prepared the material, and the connecting railroad lines between the rolling mills, the fabricating firms, and the erecting shipyard, totalled 617. All the information, templates, drawings, and the numerous details necessary for the construction of the various parts of the ship had to be kept constantly moving over a complex system, for the absence of a particular piece in the erecting yard would considerably delay the construction of the ship.

It may be added that the American International Shipbuilding Corporation received orders—firstly, for fifty "A" type cargo vessels of 8800 tons deadweight; secondly, seventy vessels of the "B" or transport type; and thirdly, a further order of sixty "A" vessels. The Submarine Boat Corporation was the second largest of what were known as the Agency yards, and had twenty-eight slipways. This yard, at the end of 1918, had delivered one ship, had nearly completed ten others, while in addition there were ten further ships in the water. It was anticipated that this organisation, which had orders for 158 ships, would have produced as many vessels as Hog Island, viz. two per week. The yard of the Merchant Shipbuilding Corporation had only ten slipways, from which it was anticipated that at least one ship a fortnight could be turned out. Through the Agency yards, therefore, it might have been expected that, had the war continued, some 230 vessels, aggregating 2,000,000 tons deadweight, or 1,300,000 tons gross, would have been completed in 1919, an output which was approximately five times the pre-war capacity in seagoing vessels of the whole of the United States.

WIDESPREAD ACTIVITIES.

It is interesting now to turn to what was done in other directions—for at the time of the Armistice it might be said that the Agency yards had contributed practically nothing to the output of seagoing vessels, and yet by December, 1918, the output of steel seagoing vessels for the year 1918 had reached over 1,850,000 tons made up of 460 vessels.

One of the most interesting features was the rapid development of shipbuilding on the Pacific Coast, for whereas prior to the war that district was responsible for perhaps only one-tenth of the average output of merchant ships, yet during the year 1918 the Pacific Coast produced nearly 48 per cent. of the steel seagoing steamers which were delivered in that year. In making this comparison it must of course be remembered that the older establishments on the Atlantic Coast were largely engaged in the production of war vessels, as, for example, the Newport News Shipbuilding Co. and the Fore River Company of Boston, while in many other directions navy requirements were necessarily heavy.

Another feature was the prolific output of the Great Lakes shipyards. Although the vessels constructed were of relatively small tonnage, yet these added considerably to the numbers of the smaller type of seagoing vessels, and an aggregate tonnage of nearly half a million gross tons was launched in 1918.

The table on page 201 shows that the monthly output of steel seagoing steamers greatly increased between April, 1917, and April, 1919, in which latter month the number of completed vessels grew to seventy-five with a tonnage of over 315,000 gross. It is fairer, however, to compare the rate of output, for whereas for the year ending April, 1918, the rate of production was about 850,000 tons gross, yet the efforts of the following twelve months had succeeded in raising the year's output to 2,350,000 steel steamers alone, a phenomenal increase considering the previous experience of the country in shipbuilding and the want of existing facilities in 1917.

Many interesting records were established in regard to rapid construction, and although it was urged that such quick work necessarily made for inefficiency, yet, considering all the difficulties, the work was exceedingly well performed—in fact, in several of the new shipyards the performance was excellent.

PRODUCTION OF WOODEN VESSELS.

The third marked feature of the shipbuilding effort was concerned with the production of wooden vessels which grew from a very small output of 50,000 tons per annum in 1916 to 160,000 tons in 1917, and reached nearly 1,000,000 tons in 1918. It was only to be expected that the greater part of this construction took place on the Pacific Coast, where timber is more readily available and where there was a greater proportion of labour accustomed to handling such material. In fact, practically two-thirds of this output was built on that coast. It speaks well, therefore, for the capability of the directing forces and for the energy which the people put into their labour that such a marked increase was possible under very unfamiliar conditions.

Considerable scorn has been heaped on the wooden shipbuilding programme of the United States Shipping Board, but there were no doubt certain uses to which this shipping could be put, and it could certainly serve to replace a fair amount of steel tonnage in coastwise traffic and in lumber traffic westwards. It was not, however, to be expected that such vessels could, with advantage, be used under winter conditions in the North Atlantic, nor that, with the unseasoned timber which had, of necessity, to be used, such vessels would be able to encounter heavy seas without giving considerably more trouble and experiencing much more leakage than would be found in a steel vessel.

One of the great difficulties in this programme was the provision of machinery and boilers for the vessels, since propelling plant had to be manufactured in localities and by people who had had very little experience of marine engineering in any shape or form; and while the ships themselves perhaps left much to be desired, the same thing must of necessity be said in regard to the machinery.

Many people also overlooked the fact that it was extremely difficult to man the vessels and to get a crew and engineering staff which were at all conversant with the responsibilities incurred at sea. It may be said, in brief, that all these factors require very close consideration if any proper opinion is to be formed of the wooden shipbuilding effort. Taking it on the whole, it must be said that it was a magnificent effort, and that, considering all the circumstances, as good a performance as was humanly possible seems to have been attained.

DEVELOPMENT AND DISTRIBUTION.

The attached tables are of interest in showing the development and the distribution of the shipbuilding work undertaken during the war. Table I. shows the total tonnage under construction at various periods, and indicates that the capacity of the coast shipyards was nearly quadrupled in two years, rising from a figure of 700,000 in 1917 to 2,740,000 at the beginning of 1919. On the Great Lakes,

TABLE I.

VESSELS UNDER CONSTRUCTION (GROSS TONS).

	Beginning of			
	1917.	1918.	1919.	1920.
Coast Yards	700,000	1,100,000	2,740,000	2,250,000
Great Lakes	100,000	200,000	380,000	170,000
Wood Vessels	?	750,000	1,070,000	150,000
Total . . .	800,000	2,050,000	4,190,000	2,570,000

which had a plant capacity of about 250,000, the actual tonnage under construction was not up to the average figure in 1918, but had reached about 380,000 in 1919. The tonnage under construction, however, is not always a good comparison as there was a much greater turnover per slipway in some districts than others.

The tonnage of vessels launched, as given in Table II., shows that whereas on the Great Lakes the amount under construction had only gone up by a small extent, yet the output was double that of the best pre-war record and was nearly three times for 1919 what it was in 1917.

TABLE II,

VESSELS LAUNCHED (GROSS TONS).

	1907.	1916.	1917.	1918.	1919.
Coast Yards . .	170,000	330,000	660,000	1,660,000	3,040,000
Great Lakes . .	260,000	120,000	180,000	*430,000	*500,000
Wood Vessels . .	60,000	50,000	160,000	940,000	530,000
Total . .	490,000	500,000	1,000,000	3,030,000	4,070,000

Comparing the vessels launched in different years in the coast yards, it will be seen that whereas the tonnage put in the water in 1916 was 50 per cent. in excess of the best pre-war record, yet within twelve months the output had doubled, and by 1919 was approaching ten times the previous best of 1916.

The development in wood shipbuilding was even more startling, for whereas the total tonnage under construction in 1916 was very small and the output for that year was only 50,000, yet in 1918 there were 750,000 tons under construction and 940,000 tons launched, a result which bears no comparison at all to anything achieved prior to the war, or to anything ever achieved in the world's history in the way of wood shipbuilding.

Table III. is based on an analysis of the output of steel seagoing steamers in 1918, when 460 vessels were produced of an aggregate gross tonnage of 1,861,000. This table indicates that the Pacific

TABLE III.

DISTRICT PRODUCTION OF COMPLETED STEAMERS IN 1918.

(460 Steel Seagoing Steamers aggregating 1,861,000 gross tons.)

	Percentage of total.	Average tonnage.	
		Deadweight.	Gross.
Atlantic Coast	30	6820	4250
,, ,, (Agency Yards)	1	8250	5160
Pacific Coast	48	8560	5350
Great Lakes	21	3510	2200

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* This total includes seagoing vessels.

Coast provided 48 per cent. of the total; the Atlantic Coast, which, as already stated, was considerably occupied by navy requirements, 30 per cent. of the total; the Great Lakes completed 21 per cent., and during that period the Agency yards, which ultimately would have produced between them nearly 1,300,000 tons gross per annum, were not yet in operation.

Judging from these figures it can certainly be said that the United States shipbuilding efforts were well on the way to produce 3,000,000 gross tons of steel seagoing ships per annum at the end of 1918, and that in a country which, prior to the war, had built very little more than 250,000 tons in any one year.

The last table (IV.) gives certain stages in the growth of the shipbuilding effort, and indicates how rapidly the annual output was increased. It might be said that, considering steel seagoing vessels alone, the output was practically trebled in twelve months, and more than trebled if both steel and wood vessels be considered together.

TABLE IV.

APPROXIMATE MONTHLY OUTPUT OF GROSS TONNAGE.

Month of	Seagoing.						Non-seagoing.		Grand total.	
	Steel.		Wood.		Total.					
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
1917.										
April	7	34,364	9	17,233	16	51,597	123	9,201	139	60,798
July	14	54,891	7	14,113	21	69,004	184	20,148	205	89,152
October	13	44,420	22	35,879	35	80,299	87	10,386	122	90,685
1918.										
January	12	53,748	6	6,468	18	60,216	39	4,579	57	64,795
April	31	130,637	15	21,017	46	151,654	119	11,396	165	163,050
July*	37	146,981	38	72,727	75	219,708	118	*10,223	193	229,931
October	57	228,203	53	117,165	110	345,368	91	12,164	201	357,532
1919.										
January†	42	174,799	37	80,957	79	255,756	†53	8,590	132	264,346
April‡	75	316,177	30	52,097	105	368,274	‡96	7,331	201	375,605

ANNUAL OUTPUT.

Year ending	Steel.		Wood.		Total.		Grand total including non-seagoing.	
	No.	Gross.	No.	Gross.	No.	Gross.		
April, 1918	203	845,338	157	236,498	360	1,081,836	1668	1,278,132
July, 1918	275	1,124,066	189	274,330	464	1,398,396	1610	1,571,572
October, 1918	396	1,594,927	287	546,613	683	2,141,540	1760	2,280,111
January, 1919	490	1,982,372	392	810,194	882	2,792,566	1957	2,920,832
April, 1919	582	2,364,479	451	947,117	1033	3,311,596	2092	3,438,076

As these tables show, in addition to the production of merchant

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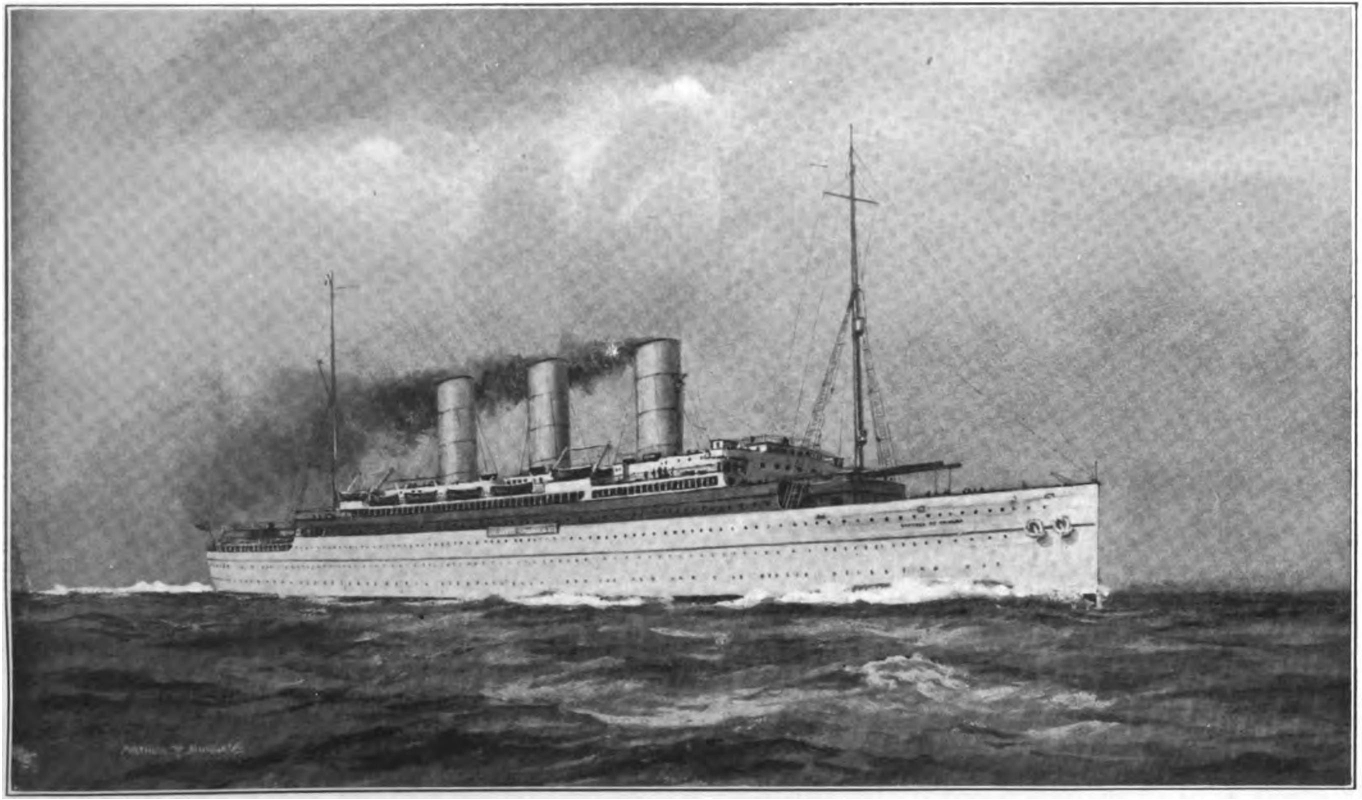
[*] Includes 1 cement vessel of 325 gross tons.
[†] Includes 3 concrete vessels of 1004 gross tons.
[‡] Includes 2 concrete vessels of 588 gross tons.

ships, there was a considerable amount of construction being carried on for local and administrative purposes, for whereas in the year ending April, 1919, the total of seagoing steamers produced was 1033, yet there was a further output of 1060 vessels involving about 120,000 tons.

This brief record of one of the most remarkable achievements in the history of the world may perhaps serve as an encouragement and a guide to those who realise the enormous potential energy which the United States of America possesses in regard to the future of humanity, and lead to the hope that it will be possible for the Anglo-Saxon races to work together for the common good, so that the same seafaring laws which have grown up in the last three centuries may be continued and expanded to further that free intercourse of sea traffic which must be the most potent factor in the progress of future civilisation.

In this connection it must not be forgotten that it is only three centuries ago, or more expressively ten generations ago, since Empires began to take to the seas, and the growth and development of humanity in that short span of life, brought about by seafaring adventure, is entirely beyond the contemplation of any one individual.

W. S. Abell.



(*From a drawing by Arthur J. Burgess.*)

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CHAPTER VIII.

THE ECONOMICS OF SHIPPING.

To trace the development of British Merchant Shipping from its earliest days would be the most fascinating of tasks. The earliest records of naval vessels date back to the reign of Alfred the Great, who is said to have built a fleet of galleys to repel foreign invaders; but long before then our Merchant Adventurers—as Admiral Sturdee called British shipowners a short while ago—had crossed the seas in the peaceful pursuits of trade. In every important phase of the Nation's history our Merchant Marine has played its part—a fact which, for some unaccountable reason, seems to have been very little appreciated. Drake fought the Spanish Armada with a fleet which consisted of more than half merchant vessels, and whilst it would be over bold to make a similar assertion in regard to the War of 1914–18, it is none the less true that the Merchant Marine was almost as important a factor in the successful result as either the Navy, Army, or Air Force.

It was not by accident that the outbreak of war found Great Britain possessed of a supreme Merchant Marine. There were two reasons for it, one perhaps the corollary of the other, viz. that we live in an island, and secondly, that our race is by instinct an adventurous and sea-loving race. The former is probably the root of the whole matter, because living in an island, and being under the necessity of importing a very large amount of our food, we are absolutely reliant upon shipping for our existence.

The two greatest of our national services, the Navy and the Merchant Marine, have grown up side by side—the merchant ships to feed the nation and maintain its trade, and the Royal Navy to protect the merchant ships, maintain the lines of communication, and guard our shores.

What would be our position if we had not a strong and more than sufficient Merchant Service under the Red Ensign? We should be raising a barrier against the development of our foreign trade, and opening a fatal breach in our defences, as in the event of war it would be a comparatively easy task in these days of great navies to isolate the British Isles. The statement has frequently been made that this could not be whilst our Navy is supreme; but it would be utterly impossible for the naval vessels to feed the nation, because they are built as fighting machines; any one of our greatest battle-cruisers, which are of something approaching 30,000 tons displacement, could not carry as much cargo as the smallest ocean tramp.

These opening remarks are perhaps appropriate as showing that even from the primitive standpoint of self-preservation, our Merchant Service is no less a national necessity than the Royal Navy. Both are equally essential, although their functions are different.

So far as the Merchant Service is concerned, all those who are in a position to speak with authority from admirals of the Fleet and politicians, down to shipowners themselves, admit that the Merchant Service did not fail in its task during the War. The ships were there to transport our armies to France, Italy, Bulgaria, Gallipoli, Palestine, and Mesopotamia, to convey troops to and from the Dominions, and to keep all these armies supplied; the country never went short of food, and the enemy completely failed to starve us out, in spite of his desperate attempts with mines, submarines, and raiders. At the end of it all, Great Britain still owned one-third of the world's merchant tonnage—more than any other nation. All this was achieved by private individuals—shipowners, merchant adventurers, or Empire builders, call them what you will—without the aid of Governments. The men of the Merchant Marine, of course, took a noble part in this success, and all honour is due to them for the manner in which they sailed the ships through all kinds of dangers, known and unknown.

OUR INVISIBLE EXPORTS.

But all this is merely one side of the question, and is perhaps the least important side. Attention has been devoted so far only to the importance of a large British Merchant Marine from the point of view of self-preservation, but shipping also plays a most important part in our domestic life. Our manufacturers are enabled to send their goods to every part of the world in British vessels, and that this service has been performed efficiently is evidenced by the fact that, before the War, Great Britain was acknowledged to be the world's common carrier by water. It may be said that if British vessels did not carry these home manufactures to their foreign markets, American, Scandinavian, or Japanese vessels would be only too willing to do so. So, no doubt, they would, but there is this difference. The service would not be performed more efficiently and the freights would have to be paid to these foreign carriers, instead of being paid to British steamers. These freight payments would then swell the amount of our imports, *i.e.* the import of services rendered and paid for abroad, and furthermore any profits earned by those foreign ships from the delivery of British manufactures to foreign countries, would not pay any taxes to the British Exchequer, and consequently we should have to bear a heavier burden of taxation—both limited liability companies and individuals—which would have its effect, in due course, upon the cost of living, and our manufacturers would find it more difficult to compete in foreign countries, owing to their higher cost of production.

Apart from the carriage of goods for British manufacturers, it is not generally appreciated that British ships earn a large amount of revenue from the performance of services to foreign merchants by operating steamers entirely between foreign ports, such, for instance, as between North and South America, between the United States and the Far East, between Northern Europe and the Far East, and the United States and the Mediterranean. This revenue, in addition to making its proper contribution to British taxation, is in effect nothing less than a national export, and as such is one of the invisible items which help to balance our exports and imports and so stabilise our foreign exchanges, when, as a matter of fact, the Board of Trade Returns show that our visible imports far and away exceed our visible exports. The excess of imports over exports for the first six months of 1920 averaged about £40,000,000 per month, and it is safe to say that a large part of that deficiency was made good by freights paid to British shipping, a considerable proportion of which was paid entirely by foreign manufacturers and merchants.

There was a period during the War when a good deal of unfair and ill-informed comment was directed against the shipping industry. Fortunately saner counsels now prevail, and the man in the street has come to realise that the freight represents a very small proportion of the cost of any commodity. Col. Leslie Wilson, M.P., the Parliamentary Secretary of the Ministry of Shipping, in reply to a question in the House of Commons, supplied the following interesting and instructive information. He showed that the then prevailing rates of freight from the United States on the principal food imports of this country were:—

Wheat	0·24 of 1*d.* per pound.
Flour	0·35 " "
Sugar	0·375 " "
Bacon Beans Lard	0·39 " "

To put it another way, the cost of bringing wheat, for example, by rail from Devonshire to London, a distance of, say, 200 miles, was 0·1473*d.* per pound before the rates were put up 100 per cent., so that now the charge is about double. On the other hand, one of our great ocean cargo liners will land a cargo of the same commodity from the United States (a distance of 3000 miles) at less than double the cost, viz. 0·24*d.* per pound. Just think what is entailed in this operation. If a shipowner decides to contract to-day for a cargo liner of 8000 to 9000 tons carrying capacity, he has first to lay out a capital of round about £350,000, upon which he has to provide interest and depreciation. Then if he decides to bring a cargo of wheat from the United States to this country, the vessel must be despatched to the other side either in ballast or with a paucity of cargo. Then there are the time and expense represented in loading the cargo into the ship, the wages of the navigating officers, engineers, sailors, and firemen; the time and cost of discharging the cargo; the cost of about 1200 tons of coal (charged by the way by a benevolent Government administration at 50 to 100 per cent. more than the price paid by all other British industries!); the cost of wharves and docks for loading and discharging, insurance, pilotage, towage, and the hundred and one items that go to make up a disbursement account—and all at a cost of 0·24*d.* per lb. When it is remembered that, apart from interest on the larger amount of capital involved and depreciation of the ship, insurance, provisions, stores, wages and repairs have advanced five times above pre-war levels, it is surely remarkable that this figure should be so low.

It is a simple arithmetical calculation, but it is not generally realised, that a freight of 50*s.* per ton on any particular commodity only represents ¼*d.* per pound. In face of such facts it will readily be seen that the high prices for our imports cannot be laid at the door of the shipping industry.

It has been already mentioned that the cost of building a cargo liner to-day works out at something like £350,000. It may with some reason be argued that a considerable percentage of tonnage afloat to-day was constructed at a cost far below the building costs now prevailing. In pre-War days the cost of carrying grain to the British Isles from the United States represented about one-sixteenth of a penny per pound. But the operating costs of a voyage are now, as has been stated, about five times as great, and whilst the percentage of profit has been greater, this has applied to all industries. It is not typical of the shipping trade alone, but is a natural result of the War. It is true that in some cases owners sold their vessels and rested from their labours, but generally speaking these increased profits have been retained in the companies and invested in War Loans or utilised in the development and extension of the business by the acquisition of additional tonnage at a very high cost.

Shipping and Employment.

Justly we have a national pride in our Merchant Marine. A survey of the economics of shipping would be incomplete without reference being made to the widespread influence which the industry exercises on employment in this country. According to official figures, the crews of British merchant ships number nearly 300,000 men, of whom about two-thirds are British, the remainder consisting for the most part of Lascars, who are, of course, also citizens of the British Empire. If the British Mercantile Marine merely sufficed to supply the needs of this country and there were not British ships trading between foreign ports and carrying foreign cargoes, the service would necessarily offer a much smaller amount of employment. The prosperity of shipping reacts powerfully on the fortunes of a large number of persons of all classes, but particularly the wage-earning classes who get their living on shore. In particular, the pre-eminence and size of the British Mercantile Marine has stimulated the shipbuilding and engineering industries, besides contributing to the prosperity of many other trades which are concerned with the equipment and the fitting out of vessels.

The importance, however, of the shipping industry to the general community cannot be estimated by these particulars alone. The import of food and materials and the binding together of the different parts of the British Empire are matters of supreme importance. All the most important trades of the country are dependent on shipping for the import of the raw material and for the export of their manufactured goods. The shipbuilder brings in his iron ore, the woollen manufacturer brings in his wool, the cotton manufacturer brings in his cotton, the merchant brings in his fruits, and they all in a greater or lesser degree export their manufactured articles, so that the hundreds of industries in this country are all more or less dependent on the organisation of the great shipping and liner companies for the regular and punctual deliveries and export of their goods, without which these businesses would cease to exist. Situated as the country is—dependent as we are upon imports—it would be inconsistent with our continued existence and prosperity that the shipping services now rendered should pass into foreign hands.

Without appearing to indulge in language of exaggeration, it may be claimed that, had it not been for the existence of the British Mercantile Marine, this country, in all probability, would have been under German rule to-day.

THE OUTLOOK FOR THE FUTURE.

But what of the future? We hear many parties clamouring for shipping to be nationalised. For every argument in its favour there are twice as many more powerful arguments against it. A shipowner's opinion may be regarded in the eyes of the world as biased. But surely shipowners, with their experience and knowledge, are the very people who are best able to view the matter from all angles and give an informed opinion? If we want an opinion on a matter of law we go to a lawyer for it, and this should be equally true of shipping and every other profession.

Apart from the fact that shipping is essentially an international trade, bureaucratic control would be a mistake. The President of the Chamber of Shipping has expressed the view that "Government control is always extravagant and wasteful. It destroys all initiative. It stereotypes mediocrity. The cost is infinitely more than the shipowners' margin of profit and the cost of management combined." Although they perhaps look at the matter from a different point of view, the men who actually navigate the ships and are dependent upon shipping for their livelihood share the same opinion. Mr. Havelock Wilson, the President of the National Sailors' and Firemen's Union, has not hesitated to express his views. This is what he says:—

"I have no hesitation in saying that it would not be profitable to the State to run ships. In the course of years there would be so much money lost on the venture that the Merchant Shipping of Great Britain would gradually dwindle."

We have before us the evidence of the United States Merchant Fleet—the greatest attempt at Maritime nationalisation that the world has ever seen. This is not the time or place to reflect upon this commercial tragedy, because, in the first place, the circumstances under which the new Merchant Marine of America was built are unique, and, secondly, American business men have quickly realised that it is impossible for a huge organisation successfully to operate a great fleet of merchant ships, and every encouragement is therefore being given to private citizens to acquire the ships and run them by private enterprise. None the less, we can profit by the lesson of their experience. During the first year after the War, when freights were at the highest point ever reached in the history of the world, the steamers owned by the American Government, which represented an investment of 2,000,000,000 dollars, earned a profit of between 100,000,000 and 120,000,000 dollars, before making any allowance for depreciation or overhead expenses, and presumably without charging against those profits anything for taxation. These figures show that these Government-owned ships made a gross profit of 5 per cent. per annum, and that, after depreciation and overhead expenses were written off, there was an actual loss in trading. This was during a period when British vessels were compelled to carry a foreign Government cargo at nominal rates, very much less than the market rates prevailing, while the American ships were free to take the highest rates procurable in the markets of the world. Surely there could be no better illustration of the impracticability of any Government bureau operating a nationalised fleet of Merchant ships either at a profit or with increased efficiency, which are the only two grounds upon which the nationalisation of the British Merchant Fleet could be justified.

The fact is that immediately a Government Department interests itself in trading, it becomes involved in the cross currents of politics, both national and international, and of no trade is this fact truer than of shipowning. In building up the British Merchant Marine to its present state of efficiency, many widespread organisations have been established throughout the world. Agreements are entered into with foreign companies, property is purchased or leased abroad, such, for instance, as wharves, piers and warehouses, and very often capital is invested in the business of steamship agencies in different parts of the globe. All this organisation would have to be scrapped, for who can imagine private companies admitting Foreign Governments into partnership in their business?

It is not generally realised how many other businesses are bound up with shipowning, to a greater or less degree, and which would be affected by the nationalisation of shipping. Insurance and banking are two examples. Government-owned ships are not insured, so the marine insurance community could look elsewhere for employment, and the losses and repairs of ships would fall directly upon the taxpayer. The banking business—the remittances of freights and payment of disbursements in every part of the world—would presumably be undertaken by a branch of the Treasury, and so the loss of business to the commercial community could be traced down through countless industries. Shipowning is not like working a railway, or system of railways, which can be operated in a sort of watertight compartment, affecting no international relations, and bringing in no revenue from outside the country.

British shipping, in the hands of private individuals, has not failed to provide for the nation's needs, either in war or peace; it has been one of the principal instruments in Empire building; it is one of the chief links in the chain which binds our Dominions to us; and it brings grist to the country's mill, both in the direct form of taxes on profits earned abroad from foreign countries, and in the indirect form of providing employment and profit to innumerable affiliated industries.

What, then, should be our policy for the future—to strangle this industry, which has admittedly performed all its duties satisfactorily, even to the extent of conveying all its foodstuffs from the farthermost parts of the earth at an average rate of a fraction of a penny per pound; or, on the other hand, to encourage it to even greater efforts? Surely the latter course is the best policy! There must be no looking back, because, to put the case in a nutshell, we must have an efficient and sufficient Merchant Marine to ensure our own internal needs, and we must have a surplus of ships to earn money abroad and help balance our exchanges, otherwise national bankruptcy will, sooner or later, overtake us.

FREDERICK W. LEWIS.

CHAPTER IX.

FREIGHTS DURING THE WAR.

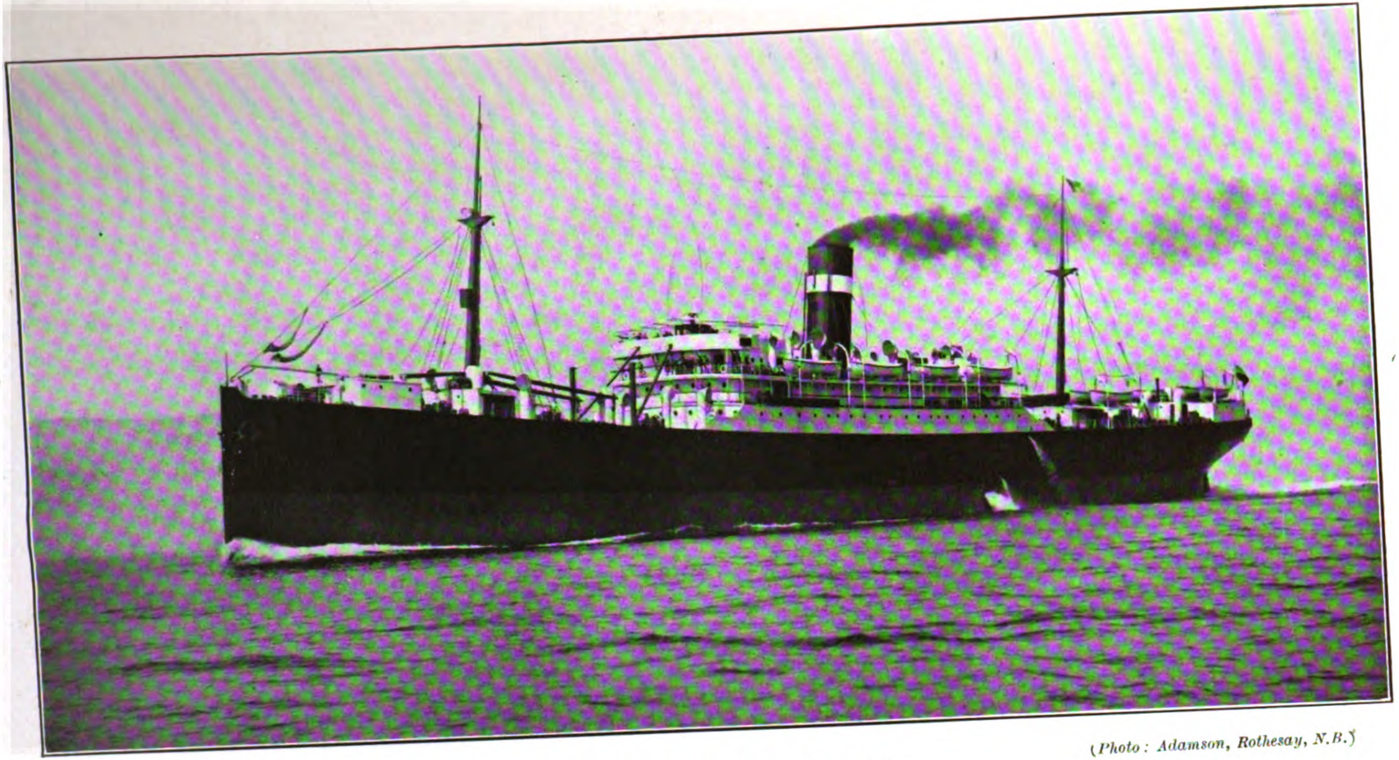
THE importance of the Mercantile Marine as subsidiary to our Navy has been emphasised during the Great War, and it is fully realised how absolutely essential it is for the welfare of this country that our Merchant Navy shall be maintained not only for commerce but for our protection.

During the prolonged struggle, all previous ideas of the functions and power of the State changed. By a gradual process forced upon the nation, all energies were required to be directed to the prosecution of the War, and private interests were willingly handed over to public control when it was found that the safety of the nation required that sacrifice.

It is characteristic of our British methods that the control of the British Mercantile Fleet was only undertaken step by step as the course of events and the experience gained showed that it was necessary and unavoidable. An unexpected feature was the means that were adopted to secure the assistance of neutral tonnage, and it is therefore interesting to offer some facts showing how the control of British shipping arose and was carried out, and how arrangements were made for assistance from the Mercantile Fleet of neutral powers.

Stunned by the unexpected declaration of War, and feeling the full force of the financial chaos that followed, shipping, during the first few months after the outbreak, experienced great difficulty in securing employment, and freights were depressed. Many charters arranged before the War were cancelled, and the general dislocation of trade that immediately followed showed little sign of recovery. Owners were pessimistic, anticipating that the annihilated world's trade could not employ the available tonnage. So little confidence was then shown that neutral steamers seized the opportunity of accepting 5*s.* on the deadweight ton per month for a six years' time-charter, anticipating that the War could only be of a short duration, and that such a rate was worth securing for the future.

At the outset of the War, all British steamers that were required for the carriage of troops, stores, and coal for the Navy were requisitioned by the Government, and an arrangement was ultimately arrived at with the shipowners that they should receive a freight which left a small profit on the value prevailing at that time. Tramp steamers over 5000 tons were paid 11*s.* per gross registered ton—equal to about 7*s.* on the deadweight—proportionately higher rates being paid for smaller steamers; slightly higher allowances



(*Photo: Adamson, Rothesay, N.B.*)

DONALDSON LINER CASSANDRA.

Built and engined by Messrs. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, N.B.

were made for boats of high speed. Up to about 20 per cent. of British tonnage was at first employed for this purpose.

Early in 1915 confidence was gradually restored, and the impotency of the surface craft of the German fleet to interfere with shipping to anything but a negligible extent enabled trade to be generally resumed, and freight markets rapidly recovered.

The rate on time-charter at the commencement of 1915 for tramp steamers of about 6000 tons was about 5*s.* per ton deadweight per month, steadily advancing to about 12*s.* 6*d.* in July for charters of twelve months. This was largely owing to the increasing demands for the use of tonnage from the United States and Allied countries. Even at this period, some owners were inclined to discount the future and accept a lower rate for a period of eighteen months. Yet, by the end of the year, the market had advanced to 22*s.* 6*d.*

British and Neutral Freights.

Up to this time, there was scarcely any difference in the freights obtained by British and neutral boats; but in November the Board of Trade started a Licensing Committee to facilitate such fixtures as would assist the Allied Governments, and prevent boats being employed in what were considered unnecessary trades. In conjunction with this Committee, there was likewise established the "Requisitioning and Carriage of Foodstuffs Committee," which specially directed tonnage for United Kingdom grain cargoes.

In consequenee of the activity of these Committees, time-charterers were inclined to favour neutral boats, owing to their having no liability to be requisitioned and directed, and the demands became so great, owing to the increasing requirements of the Allied countries and the United States, that freights continued to soar up, and by the end of 1916 neutral boats were obtaining as high as 42*s.* 6*d.* and 45*s.* on the deadweight, according to size. Undoubtedly, if it had not been for the action of the Government in controlling the supply of British bunkers (with a view to enforcing the blockade of Germany) and providing coals and granting preferential treatment to such neutral boats as were willing to conform to the wishes of the Admiralty—afterwards extended to steamers that were trading in Allied services—there would have been a great inducement for them to leave European waters and proceed to America, where the risks were negligible.

The Bunker Committee in charge of these regulations deserve the greatest praise, as, although they had vast powers, they were used with the utmost discretion and consideration; and neutral owners generally had great confidence in the treatment received. Our coal measures constituted indeed an important contribution to victory, for by regulating bunkers we were able to ensure the services of a great volume of neutral tonnage at fairly reasonable rates.

If this committee had not been in existence neutral rates must have advanced to unparalleled heights, as the Allied Governments would have been compelled to offer the most fabulous figures in order to tempt them to continue trading in the War zone.

The increasing demands caused the gradual development and expansion of State Control in every direction. Maximum rates for the supply of coals to France and Italy were arrived at by mutual agreement between British shipowners and the Board of Trade in the early summer of 1916, and they proved of very great benefit to our Allies. The maximum rates from Cardiff to Rouen were 24*s.* 6*d.* and other French ports proportionately, and to Italy—from Cardiff to Genoa—59*s.* 6*d.* These rates, however, were too low to persuade many neutral steamers to accept such employment, although later the rate was increased 50 per cent. for foreign tonnage to cover the heavy War Insurance, and therefore the bulk of the trade was done by British boats. In addition to carrying coals for the Allied countries, the British owners were required to return with ore from the Mediterranean and Spain to the United Kingdom at freights that must have shown a loss.

INCREASING SHORTAGE OF TONNAGE.

During this year the increasing demands for tonnage on account of the Allies exceeded all expectations; and, for the first time, the supply of steamers only sufficed for the world's most urgent requirements. Consequently, it was considered necessary to exercise a still greater control of British tonnage; and the Ministry of Shipping was created in December, 1916, and took charge of the whole of the British Mercantile Fleet. By doing so, it undoubtedly prevented any waste of tonnage in employment that would not have been of direct benefit to the Allied countries.

At the same time, the Allied Governments established in England a committee for the chartering of all neutral steamers on their behalf, thus preventing the unnecessary competition amongst themselves which undoubtedly had helped in the past to advance rates. The neutral tonnage thus chartered was divided amongst the Allies and employed for their necessary services—very largely by France and Italy. This kept freights steady, and during the first half of 1917, on time-charter they ruled about:—

1000/2000 tons d.w.	50/-
2000/4000 „ „	48/9
4000/6000 „ „	47/6
Over 6000 „ „	42/6

Charterers paid all War Insurance over one per cent.

It was considered unnecessary at first to control steamers of under 1000 tons, with the result that rates advanced to as high as 120*s.*, and it was found imperative to also control the smaller boats. It was ultimately agreed that maximum rates should be fixed as follows:—

Up to 500 tons d.w.	58/-
„ „ 1000 „ „	54/-
„ „ 2300 „ „	49/-
„ „ 4000 „ „	46/6
„ „ 6000 „ „	43/6
Over 6000 „ „	41/6

In these circumstances also charterers paid all War Insurance.

An arrangement was made with the Norwegian shipowners that, in return for the supply of coal, they should place at our service such tonnage as was not needed for their own country's requirements—an agreement which worked with extreme smoothness. The sympathy shown by the Norwegian business-people was of great practical value, as the tonnage we then received was of the greatest help and eased the difficult situation which had arisen.

ADVANTAGES OF SHIP CONTROL.

The cost to England at this time for carrying wheat from the United States was 8*s.* 6*d.* per quarter, whilst neutral European countries were compelled to pay 40*s.* per quarter to secure the necessary tonnage. For mixed cargoes Italy paid 360*s.* per ton net charter, and Spain and France 260*s.*, from the United States.

In 1918 rates remained the same owing to these various controls, and the year was particularly marked by the closer co-operation between the Allies for their transport services, all British, Allied, and Chartered Neutral tonnage being more or less under the direction of the Allied Maritime Transport Council, which dealt with the distribution of the important supplies to the Allied countries. Thus tonnage was used in the most economical manner possible.

An agreement was also made this year with the Swedish and Danish owners whereby they placed their surplus tonnage at our disposal in return for food supplies and coal, this arrangement being possible owing to the United States having fortunately come into the War.

The neutral tonnage available was also further increased by the requisitioning of Dutch steamers that were lying idle in the United States and other ports, and the rates paid were more or less based on those that were being paid in 1917, so that the owners had no cause to complain of the generous treatment they received at the hands of the Allies.

BRITISH SHIPS AND THE ALLIES.

This year British shipowners were asked to place all their tonnage at the disposal of the Government. Many lines established for a generation were deprived of all steamers for the maintenance of their normal services, and the results attained by years of labour had to be sacrificed in the great war effort then being made. As a consequence of this necessary action, it will take years to work up again the splendid organisations that had slowly but surely been built up by skilful and persistent effort and undaunted enterprise.

The contribution made by this country to the Allied victory can be estimated by the fact that, in 1918, 43 per cent. of the imports to France were carried by this country, and 49 per cent. of the imports to Italy. Besides this, we carried a million American troops from the United States to France. These great efforts and the magnificent way in which they were organised undoubtedly contributed largely to the happy termination of the War.

Owing to the increased cost of stores, supplies, and repairs, shipowners were unquestionably suffering hardships early in 1918 owing to rates of freights that had been fixed. An investigation was held at the request of the shipowners by accountants appointed by the Ministry of Shipping and the Chamber of Shipping. As a result, an increase of rates ranging from 49 per cent. for the smallest vessel to 22 per cent. for the largest was allowed by the Government to take effect from March, 1918.

It was felt by the British shipowner to be a great handicap that whilst neutral steamers were paid high rates by the Allied Governments British steamers were receiving such low remuneration; but it must be remembered that, before the United States came into the War, if the neutrals had not been tempted by high freights, the probability is that they would all have found employment outside Europe.

The important feature of the British Mercantile Marine since the declaration of Peace has been the energy displayed by the old-established Companies to regain and maintain their pre-War position. If they had not been allowed in the early part of the War to make profits (which, after all, in many cases were entirely contributed by countries that were merely spectators), it would have been impossible for them to have purchased new tonnage at its enormously increased cost, knowing full well that, in the ordinary course of events, these values would come down probably 50 per cent., and that a dead loss would ultimately be incurred. Yet, if they had waited until the cost of new steamers had become normal, the neutral countries that had so largely benefited during the War, would, no doubt, have so established their hold upon the shipping trades of the world that it would have been extremely difficult ever to have regained our premier position.

However, this country fortunately has the "sea sense" developed to so high a degree, that, if not interfered with by unreasonable Government restrictions, we may confidently hope to retain our supremacy in the shipping world.

O. G. HOLMDEN.

CHAPTER X.

THE SAILING SHIP'S SALVATION.

"To be or not to be?" is a question which has often been asked with regard to sailing ships, and has received various answers in recent years according to the mood of the person to whom the interrogation was put or to the special circumstances which prevailed at the time of the query. Just prior to the War it almost seemed as if the death-knell of the "wind-jammer" had been sounded, but the life-and-death struggle resulting from the intensive submarine campaign led us to summon to our aid every vessel capable of transporting anything across the water, and it caused no small flutter of pride in the breast of many an ancient mariner to hear of craft once again in commission whose names were famous in the long ago for fast passages and big carrying capacity. But these are times of rapid—nay, even revolutionary—change, and the consequence is that the old Shakespearean question is being more anxiously asked than ever.

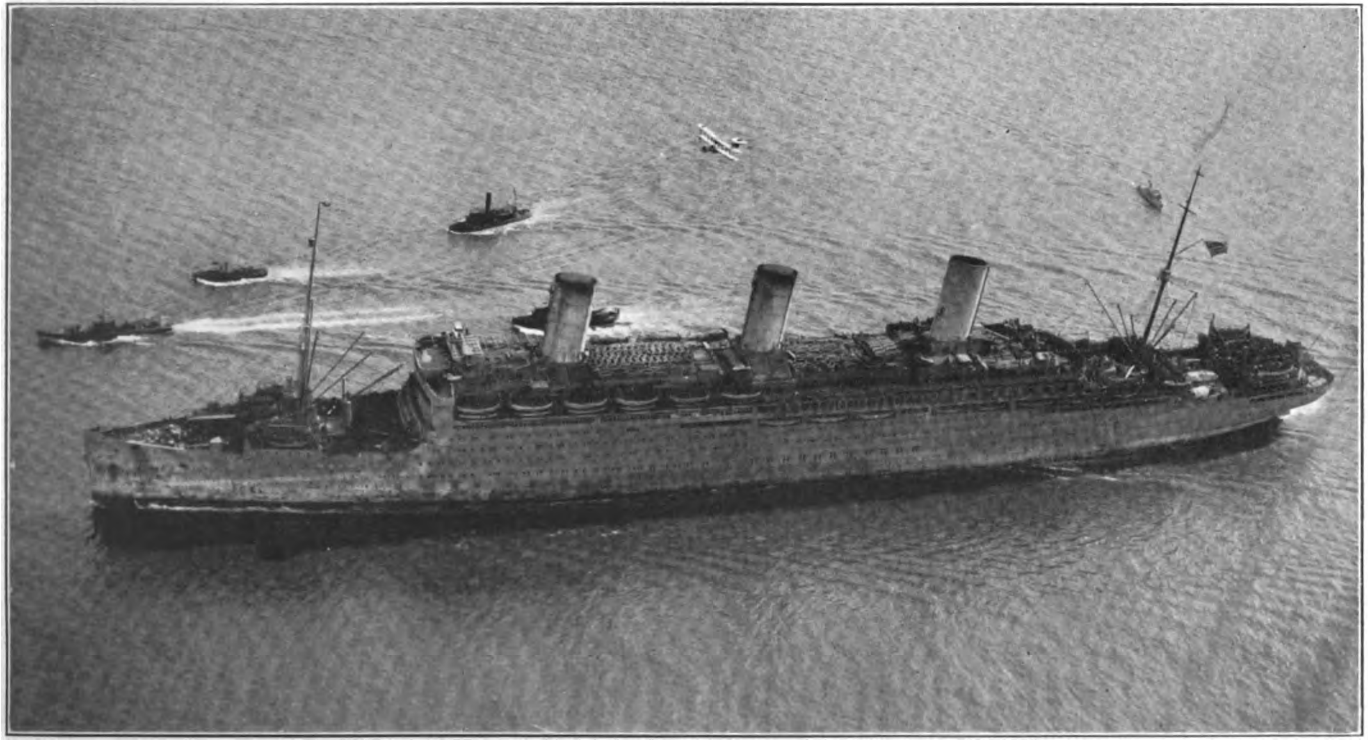
The reports of liners crossing the Atlantic at 26 knots, and of small men-of-war, such as destroyers, attaining speeds of 38 knots or more, in association with the rates at which motor-cars travel in these days, have tended to give people an exaggerated idea of the importance of high speed. There is a tendency to overlook the obvious fact that high speed is very expensive, and to forget that even in these days of the steamship most of our exports and imports are carried in vessels of comparatively small power. On the eve of the War 60 per cent. of our steam tonnage consisted of tramps, and the average tramp does not maintain more than 8 or 9 knots. This generation, which accepts the steam engine as a commonplace, is unfamiliar with the triumphs of speed of the sailing ships of former days, when speed was not reflected in a costly coal bill and all the expenses associated with the maintenance of boilers and engines. In the early days of steam navigation the clippers held their own for a long time against the steamship, and, in view of the higher cost of steamship construction and maintenance and the high price paid for coal, it may be suggested that conditions now favour the sailing ship for the movement of certain kinds of cargoes, if not of passengers.

It is possible for things to cost us too dear. One day we may discover that it is not the height of wisdom nor the soundest economy for an "Atlantic Greyhound" to be driven from Liverpool to New York at the speed in vogue to-day; just as we may also find, after all, that the horse has some advantages over motors when petrol is 5*s.* a gallon. At the present time steamship owners are undoubtedly appalled at the cost of new tonnage; at the time taken over repairs; and at the high running costs of their fleets. There seems therefore a decided chance for the sailing vessel to be re-born and to resume its rôle in helping to bear the world's burden of goods to be carried across the "vasty deep." Obviously the sailer is not fitted or intended for any and every trade, but for *certain* kinds of traffic and between certain points it can and will easily hold its own. The pure sailing ship has no costly engine and boiler installation upon which a dividend must be earned; it has no big bunkering bills to be continually "footing": it just uses the free and glorious "winds of God" which are "without money and without price." Of course it has its drawbacks. On the rolling main it can well look after itself and "show a clean pair of heels" (if one may be allowed the simile) to many an average power-craft; but when it comes to port it must often, alas! seek aid from steam to bring it into "the haven where it would be," and when once safe and sound in harbour must even there be condemned to "wait turn" until the powers-that-be choose to let it discharge its cargo. The sailing vessel may be picturesque and it may be economical, but it is not really ideal for modern needs.

To use the free forces of nature is an excellent proposition in theory, but unfortunately the particular forces of nature in question have not that constancy about them which reliable service requires; hence the ideal seems to be to supplement nature by a little human ingenuity. If there ever was a doubt as to the survival of the pure sailing ship there is no possible shadow of doubt as to the enduring place now being steadily carved out for itself by the "auxiliary" (as the sailing vessel with a helping marine motor installed in her has come to be popularly called). To sail when the winds are favourable, and to "taxi" in and out of port and when a dead calm prevails, is surely the perfection of economy. The fact that owners of sailing ships from 100 tons to 10,000 tons burden are hastening to equip their boats (as fast as monetary considerations and industrial conditions will allow) with auxiliary motors from 45 H.P. upwards to sizes undreamt of a few years ago, proves that the day of the decease of the sailer is not yet: indeed, that it is being resurrected to a life of greater utility and glory than ever before.

Like every new development it has many difficulties and prejudices to overcome, new experiences to be undergone, new men to train, new fields to explore; but what has already been accomplished has begotten unbounded enthusiasm and opened up a vista of possibilities as to how to meet the shipping requirements of the new conditions of this new age. And it surely is a sign of the times, and evidence of a keenness of vision which does it credit, that the Chamber of Shipping of the United Kingdom has recently created a special section to protect and advance the interests of owners of sailing and auxiliary motor sailing vessels.

J. W. EASON.



(*Photo: Topical Press.*)

THE EX-GERMAN LINER VATERLAND (NOW THE LEVIATHAN) WITH 9000 U.S. TROOPS ON BOARD.

(*For particulars see p. 329.*)

CHAPTER XI.

THE AMERICAN MERCHANT MARINE ACT, 1920.

ON June 5, 1920, President Wilson signed an Act "to provide for the promotion and maintenance of the American Merchant Marine, to repeal certain emergency legislation, and provide for the disposition, regulation, and use of property acquired thereunder and for other purposes." Under the emergency legislation, passed after the entry of the United States into the Great War, the American Government constructed a large number of commerce carrying ships. Sir Westcott Abell, Chief Surveyor of Lloyd's Register, describes this movement in a previous chapter. The Merchant Marine Act, 1920, lays down the principle governing the ownership and operation of the vessels constructed under the authority of Congress. In the preamble, it is stated that "it is necessary for the national defence and for the proper growth of its foreign and domestic commerce that the United States shall have a merchant marine of the best equipped and most suitable types of vessels sufficient to carry the greater portion of its commerce and serve as a naval or military auxiliary in time of war or national emergency, ultimately to be owned and operated privately by citizens of the United States." In this way, at the very outset, Congress declared against the continued ownership by the State of the vessels built by the State.

It is unnecessary to recapitulate the emergency legislation which is repealed by the Act of 1920. The most important change is in Section 3 of the Shipping Act, 1916. Provision is made for the setting up of a new United States Shipping Board, composed of seven commissioners, who will continue in office, two for a term of one year and the remaining five for a term of two, three, four, five, and six years respectively from the date of their appointment, the term of each of the latter members being designated by the President. Their successors, however, will be appointed for terms of six years, any person chosen to fill a vacancy holding office for the unexpired term of the commissioner whom he succeeds. Each member of the Board will receive a salary of $12,000 per annum. It is laid down:—

> The commissioners shall be appointed with due regard to their fitness for the efficient discharge of the duties imposed on them by this Act, and two shall be appointed from the States touching the Pacific Ocean, two from the States touching the Atlantic Ocean, one from the States touching the Gulf of Mexico, one from the States touching the Great Lakes, and one from the interior, but not more than one shall be appointed from the same State. Not more than four of the commissioners shall be appointed from the same political party. A vacancy in the Board shall be filled in the same manner as the original appointments. No commissioner shall take any part in the consideration or decision of any claim or particular controversy

in which he has a pecuniary interest. Each commissioner shall devote his time to the duties of his office, and shall not be in the employ of or hold any official relation to any common carrier or other person subject to this Act, nor while holding such office acquire any stock or bonds thereof or become pecuniarily interested in any such carrier.

This is the authority which will be responsible for interpreting the Marine Act of 1920. Subject to this enactment, it will have control over all the emergency shipping, except that belonging to the War Department. The Board is directed to sell, "as soon as practicable, consistent with good business methods and the objects and purposes to be attained by this Act," at public or private competitive sale to American citizens the vessels built under the emergency legislation; it is declared that the completion of the payment of the purchase price and interest shall not be deferred more than fifteen years after the making of the contract of sale. "The Board in fixing or accepting the sale price of such vessels shall take into consideration the prevailing domestic and foreign market price, of the available supply of, and the demand for vessels, existing freight rates and prospects of their maintenance, the cost of constructing vessels of similar types under prevailing conditions, as well as the cost of the construction or purchase price of the vessels to be sold, and any other facts or conditions that would influence a prudent, solvent business man in the sale of similar vessels or property which he is not forced to sell." With the assent of not less than five members, the Board may sell to aliens any surplus vessels "unnecessary for the promotion and maintenance of an efficient American Merchant Marine," provided that no American purchasers can be found and that the completion of the payment of the purchase price and interest—at not less than 5½ per cent. per annum payable semi-annually—may not be deferred for more than ten years after making the contract for sale.

New Steamship Lines.

Section 7 of the Act is one of the most important. The Board is directed to investigate and determine as promptly as possible what steamship lines should be established and put in operation from American ports to such world and domestic markets as in its judgment are desirable for the promotion, development, expansion, and maintenance of the foreign and coastwise trade of the United States and an adequate postal service. The Board will determine the type, size, speed, and other requirements of the vessels to be employed upon such lines, and the frequency and regularity of their sailings, with a view to furnishing adequate, regular, certain, and permanent service. If any such steamship line is deemed desirable and necessary, and if no citizen of the United States can be secured to supply it by the purchase or charter of vessels on terms satisfactory to the Board, the Board is empowered to operate vessels on such line until the business is developed so that such vessels may be sold on satisfactory terms and the service maintained, or "unless it shall appear within a reasonable time that such line cannot be made self-sustaining."

Where steamship lines with regular service have already been established, "such lines and service shall be maintained by the Board until, in the opinion of the Board, the maintenance thereof is unbusinesslike and against the public interest." It is also laid down that "whenever the Board shall determine . . . that trade conditions warrant the establishment of a service or additional service under Government administration, where a service is already being given by persons, citizens of the United States, the rates and charges for such Government service shall not be less than the cost thereof, including a proper interest and depreciation charge on the value of Government vessels and equipment employed therein."

Section 8 deals with the powers of the Board to promote, encourage, and develop ports and transportation facilities; and Section 9 insists upon the purchasers of vessels keeping them insured. The next section deals with the creation of a separate insurance fund, which the Board may use to insure, in whole or in part, against all hazards commonly covered by insurance policies in such cases, any interest of the United States (1) in any vessel either constructed or in process of construction, and (2) in any plants or materials heretofore or hereafter acquired by the Board or hereby transferred to the Board."

Under Section 11 provision is made for a construction fund.

> During a period of five years the Board may annually set aside out of the revenues from sales and operations a sum not exceeding 25,000,000 dols., to be known as the construction loan fund, to be used in aid of the construction of vessels of the best and most efficient type for the establishment and maintenance of service on steamship lines deemed desirable and necessary by the Board, and such vessels shall be equipped with the most modern, the most efficient, and the most economical machinery and commercial appliances. The Board shall use such fund to the extent required upon such terms as the Board may prescribe to aid persons, citizens of the United States, in the construction by them in private shipyards in the United States of the foregoing class of vessels. No aid shall be for a greater sum than two-thirds of the cost of the vessel or vessels to be constructed, and the Board shall require such security, including a first lien upon the entire interest in the vessel or vessels so constructed, as it shall deem necessary to insure the repayment of such sum with interest thereon and the maintenance of the service for which such vessel or vessels are built.

No vessel purchased from the Board or documented under the laws of the United States may be sold to any person not a citizen of the United States or put under a foreign registry or flag without first obtaining the Board's approval.

DEFERRED REBATES.

Section 20 of the Act amends Section 14 of the Shipping Act, 1915. It reads as follows:—

> "Sect. 14. That no common carrier by water shall, directly or indirectly, in respect to the transportation by water of passengers or property between a port of a State, Territory, District or possession of the United States and any other such port or a port of a foreign country:—
>
> "First. Pay, or allow, or enter into any combination, agreement, or understanding, express or implied, to pay or allow, a deferred rebate to any shipper. The term 'deferred rebate' in this Act means a return of any portion of the freight money by a carrier to any shipper as a consideration for the giving of all or any portion of his shipments to the same or any other carrier, or for any other purpose, the payment of which is deferred beyond the completion of the service for which it

is paid, and is made only if, during both the period for which computed and the period of deferment, the shipper has complied with the terms of the rebate agreement or arrangement.

"Second. Use a fighting ship either separately or in conjunction with any other carrier, through agreement or otherwise. The term 'fighting ship' in this Act means a vessel used in a particular trade by a carrier or group of carriers for the purpose of excluding, preventing, or reducing competition by driving another carrier out of said trade.

"Third. Retaliate against any shipper by refusing, or threatening to refuse, space accommodations when such are available, or resort to other discriminating or unfair methods, because such shipper has patronised any other carrier or has filed a complaint charging unfair treatment, or for any other reason.

"Fourth. Make any unfair or unjustly discriminatory contract with any shipper based on the volume of freight offered, or unfairly treat or unjustly discriminate against any shipper in the matter of (a) cargo space accommodations or other facilities, due regard being had for the proper loading of the vessel and the available tonnage: (b) the loading and landing of freight in proper condition; or (c) the adjustment and settlement of claims.

"Any carrier who violates any provision of this section shall be guilty of a misdemeanor punishable by a fine of not more than 25,000 dols. for each offence."

(2) The Shipping Act, 1916, as amended, is amended by inserting after Sect. 14 a new section to read as follows:

Sect. 14a. The Board upon its own initiative may, or upon complaint shall, after due notice to all parties in interest and hearing, determine whether any person, not a citizen of the United States and engaged in transportation by water of passengers or property—

"(1) Has violated any provision of Sect. 14, or

"(2) Is a party to any combination, agreement, or understanding, express or implied, that involves in respect to transportation of passengers or property between foreign ports, deferred rebates or any other unfair practice designated in Sect. 14, and that excludes from admission upon equal terms with all other parties thereto, a common carrier by water, which is a citizen of the United States and which has applied for such admission.

"If the Board determines that any such person has violated any such provision or is a party to any such combination, agreement, or understanding, the Board shall thereupon certify such fact to the Secretary of Commerce. The Secretary shall thereafter refuse such person the right of entry for any ship owned or operated by him or by any carrier directly or indirectly controlled by him, into any port of the United States, or any Territory, District, or possession thereof, until the Board certifies that the violation has ceased or such combination, agreement, or understanding has been terminated."

The coastwise laws of the United States are extended to the island territories and possessions of the United States, not previously covered by them, and the Board is called upon to establish and maintain adequate steamship service at reasonable rates. The operation of this section is deferred, so far as the Philippine Islands are concerned, until the President is satisfied that an adequate American shipping service has been established. The Board is also authorised to issue permits for the carrying of passengers in foreign ships, if it deems it necessary to do so, between the territory of Hawaii and the Pacific coast up to February 1, 1922.

The owner of American ships operated in foreign trade is allowed, for each of the ten taxable years as a deduction from his net income, subject to War Profit and Excess Profit Taxes, to deduct an amount equivalent to the net earning of such vessels. This provision is subject to the following proviso:—

Such owner shall not be entitled to such deduction unless during such taxable year he invested, or set aside under rules and regulations to be made by the Board in a trust fund for investment, in the building, in shipyards in the United States, of new vessels of a type and kind approved by the Board, an amount, to be determined by the Secretary of the Treasury and certified by him to the Board, equivalent to the war-profits and excess-profits taxes that would have been payable by such owner on account of the net earnings of such vessels but for the deduction allowed under the provisions of this section: Provided, further, That at least two-thirds of the cost of any vessel constructed under this paragraph shall be paid for out of the ordinary funds or capital of the person having such vessel constructed.

During the period of ten years from the enactment of this Act any person a citizen of the United States who may sell a vessel documented under the laws of the United States and built prior to Jan. 1, 1914, shall be exempt from all income taxes that would be payable upon any of the proceeds of such sale under Title I., Title II., and Title III. of the Revenue Act of 1918, if the entire proceeds thereof shall be invested in the building of new ships in American shipyards, such ships to be documented under the laws of the United States and to be of a type approved by the Board.

AMERICAN CLASSIFICATION.

After making provision that all American mails shall, if practicable, be carried on board American-built vessels, it is laid down in Section 25:—

For the classification of vessels owned by the United States, and for such other purposes in connection therewith as are the proper functions of a classification bureau, all departments, boards, bureaus, and commissions of the Government are hereby directed to recognise the American Bureau of Shipping as their agency so long as the American Bureau of Shipping continues to be maintained as an organisation which has no capital stock and pays no dividends: Provided, that the Secretary of Commerce and the Chairman of the Board shall each appoint one representative who shall represent the Government upon the executive committee of the American Bureau of Shipping, and the bureau shall agree that these representatives shall be accepted by them as active members of such committee. Such representatives of the Government shall serve without any compensation, except necessary travelling expenses: Provided further, that the official list of merchant vessels published by the Government shall hereafter contain a notation clearly indicating all vessels classed by the American Bureau of Shipping.

Authority is given to American vessels to carry not more than sixteen persons in addition to the crew. And then we come to Section 28, which is one of the most important sections of the Act.

That no common carrier shall charge, collect, or receive for transportation subject to the Interstate Commerce Act of persons or property, under any joint rate, fare, or charge, or under any export, import, or other proportional rate, fare, or charge, which is based in whole or in part on the fact that the persons or property affected thereby is to be transported to, or has been transported from, any port in a possession or dependency of the United States, or in a foreign country, by a carrier by water in foreign commerce, any lower rate, fare, or charge than that charged, collected, or received by it for the transportation of persons, or of a like kind of property, for the same distance, in the same direction, and over the same route, in connection with commerce wholly within the United States, unless the vessel so transporting such persons or property is, or unless it was at the time of such transportation by water, documented under the laws of the United States. Whenever the Board is of the opinion, however, that adequate shipping facilities to or from any port in a possession or dependency of the United States or a foreign country are not afforded by vessels so documented, it shall certify this fact to the Interstate Commerce Commission, and the commission may, by order, suspend the operation of the provisions of this section with respect to the rates, fares, and charges for the transportation by rail of persons and property transported from or to be transported, to such ports, for such length of time and under such terms and conditions as it may prescribe in such order, or in any order supplemental thereto. Such suspension of operation of the provisions of this section may be terminated by order of the commission whenever the Board is of the opinion that adequate shipping facilities by such vessels to such ports are afforded and shall so certify to the commission.

The Act proceeds to specify the meaning of various definitions, and deals with domestic matters connected with the sale of ships.

Under Section 31, section 4530 of the Revised Statutes of the United States is amended to read as follows:—

"Sect. 4530. Every seaman on a vessel of the United States shall be entitled to receive on demand from the Master of the vessel to which he belongs one-half part of the balance of his wages earned and remaining unpaid at the time when such demand is made at every port where such vessel, after the voyage has been commenced, shall load or deliver cargo before the voyage is ended, and all stipulations in the contract to the contrary shall be void: Provided, Such a demand shall not be made before the expiration of, nor oftener than once in, five days nor more than once in the same harbour on the same entry. Any failure on the part of the Master to comply with this demand shall release the seaman from his contract and he shall be entitled to full payment of wages earned. And when the voyage is ended every such seaman shall be entitled to the remainder of the wages which shall then be due him, as provided in Sect. 4529 of the Revised Statutes: Provided further, That notwithstanding any release signed by any seaman under Sect. 4552 of the Revised Statutes, any court having jurisdiction may upon good cause shown set aside such release and take such action as justice shall require: And provided further, That this section shall apply to seamen on foreign vessels while in harbours of the United States, and the courts of the United States shall be open to such seamen for its enforcement."

INSISTENCE ON AMERICAN OWNERSHIP.

The following stipulations are made with reference to the ownership of American merchant vessels:—

Sect. 37. That when used in this Act, unless the context otherwise requires, the terms "person," "vessel," "documented under the laws of the United States," and "citizen of the United States" shall have the meaning assigned to them by Sects. 1 and 2 of the Shipping Act, 1916, as amended by this Act; the term "Board" means the United States Shipping Board; and the term "alien" means any person not a citizen of the United States.

Sect. 38. That Sect. 2 of the Shipping Act, 1916, is amended to read as follows:

"Sect. 2. (a) That within the meaning of this Act no corporation, partnership, or association shall be deemed a citizen of United States unless the controlling interest therein is owned by citizens of the United States, and, in the case of a corporation, unless its president and managing directors are citizens of the United States and the corporation itself is organised under the laws of the United States, or of a State, Territory, District, or possession thereof.

"But in the case of a corporation, association, or partnership operating any vessel in the coastwise trade, the amount of interest required to be owned by citizens of the United States shall be 75 per centum.

"(b) The controlling interest in a corporation shall not be deemed to be owned by citizens of the United States (a) if the title to a majority of the stock thereof is not vested in such citizens free from any trust or fiduciary obligation in favour of any person not a citizen of the United States; or (b) if the majority of the voting power in such corporation is not vested in citizens of the United States; or (c) if through any contract or understanding it is so arranged that the majority of the voting power may be exercised, directly or indirectly, in behalf of any person who is not a citizen of the United States; or (d) if by any other means whatsoever control of the corporation is conferred upon or permitted to be exercised by any person who is not a citizen of the United States.

"(c) 75 per cent. of the interest in a corporation shall not be deemed to be owned by citizens of the United States (a) if the title to 75 per cent. of its stock is not vested in such citizens free from any trust or fiduciary obligation in favour of any person not a citizen of the United States; or (b) if 75 per cent. of the voting power in such corporation is not vested in citizens of the United States; or (c) if, through any contract or understanding, it is so arranged that more than 25 per cent. of the voting power in such corporation may be exercised directly or indirectly in behalf of any person who is not a citizen of the United States; or (d) if by any other means whatsoever control of any interest in the corporation in excess of 25 per cent. is conferred upon or permitted to be exercised by any person who is not a citizen of the United States.

"(d) The provisions of this Act shall apply to receivers and trustees of all persons to whom the Act applies, and to the successors or assignees of such persons."

The sections of the American Marine Act, 1920, providing for the preferential railway rates on exports sent to the seaboard for shipment in American vessels,* and for the extension of the coastwise laws to the Philippine Islands have been temporarily suspended. Since the passing of the Act, an agreement has been reached between the American Ship and Commerce Corporation and the Hamburg-America Line for the operation of American ships on the former German trade routes in all parts of the world. In announcing that this arrangement has received the approval of the Shipping Board, Admiral Benson, its chairman, has stated:—

> We want no German money in the American end of our business, nor any agreement, expressed or implied, for German investment in any American companies. The arrangement runs for twenty years, and consists of a general agreement covering principles which the two concerns are to follow, and an operating agreement covering methods for carrying out their plans in general. It provides that each party may participate with equal amount of tonnage in both passenger and freight services as now established, which includes routes between the United States and Germany, and Germany and ports of the world other than those of the United States.
>
> The pier facilities and office organisations of both companies will be placed at the disposal of the service. The American company will act as agents of the Hamburg-America Line in the United States, whilst the German company will act similarly for the American company in Germany. Passenger service between the United States and Germany is to start within a year, the Americans agreeing to supply ships not exceeding 40,000 tons gross tonnage, to which the Hamburg-America Line cannot add unless it is agreed that business warrants it. Each party may supply half the freight service. The tonnage rates on eastbound traffic are to be fixed by the American company, westbound by the Hamburg-America company.—[Another agreement for co-operation was concluded in September, 1920, between the United States Mail Steamship Company and the North German Lloyd Company, but in this instance the period of the agreement is only five years.]

It is unnecessary to do more than recapitulate the provisions of the United States Marine Act, 1920, and to note one of the latest declarations with reference to its operation by Admiral William Benson, Chairman of the Shipping Board. A great deal will depend upon the policy decided upon by that body when it is duly constituted. At present five of the seven members have still to be selected by the President.

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* As discriminatory rates would be in conflict with thirty-two treaties with other countries, President Wilson in September, 1920, refused to enforce Section 28.

APPENDIX TO ROYAL NAVAL SECTION.

LIST OF BRITISH AND FOREIGN SHIPS.

The following abbreviations are used throughout the Alphabetical List:—

a.c.	Armoured cruiser.
a.g.b.	Armoured gunboat.
b.	Battleship.
b.cr.	Battle-cruiser.
l.cr.	Light cruiser.
Flot. ldr.	Flotilla leader.
c.d.s.	Coast-defence ship.
comp. (in armour column).	Compound or steel-faced armour.
cr.	Cruiser.
A.A.	Anti-aircraft guns.
d.v.	Despatch vessel.
g.b.	Gunboat.

g.v.	Gun-vessel.
H.S.	Harveyised or similar hard-faced steel.
K.S.	Krupp steel.
A.I.	Armstrong improved steel.
shd.	Sheathed.
P.	Protected.
t.	Turret-ship (in class column).
t.	Speed and H.P. at trials (in speed and H.P. columns).
s.c.	Sea-plane carrier.
to.cr.	Torpedo-cruiser.
to.g.b.	Torpedo-gunboat.

l.	Light guns under 15 cwt., including boats' guns.
M.	Machine guns.
sub.	Submerged torpedo tube.
A.	Armstrong guns.
K.	Krupp guns.

The following abbreviations are used to distinguish the various types of boilers:—

W.T.	Water-tube boilers, where the type is not known.
B.	Belleville.
Bl.	Blechynden.
B. & W.	Babcock and Wilcox.
D'A.	D'Allest.
D.	Dürr.
E.	Earle.
Ex.	Express.
Du T.	Du Temple.
L.	Laird.
L.N.	Laird-Normand.
M.	Mumford.

My.	Myabara.
Nic.	Niclausse.
Nor.	Normand.
N.S.	Normand-Sigaudy.
R.	Reed.
T.	Thornycroft.
T.S.	Thornycroft-Schulz.
W.F.	White-Forster.
Y^1.	Yarrow small tube.
Y^2.	Yarrow large tube.
V.E.	Vickers Express.
cyl.	Cylindrical.

The following abbreviations distinguish types of turbines:—

P.T.	Parsons.
S.	Schneider.
C.T.	Curtis.
B.C.T.	Brown-Curtis.

A reference is now given in the ship tables to the plates in which diagrams of the ships appear.

GREAT BRITAIN.—Armoured Ships.

Class	NAME	Displacement.	Length.	Beam.	Draught	Horse-Power.	Where Built.	Makers of Engines.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Fuel.	Complement.
												Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.		Coal. Oil.	
																Heavy Guns.	Second-ary.					
		tons	ft.	ft.	ft.						£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	**Agincourt**[1] (*ex* Osman I) *Pl.* 5.	27,500	632	89	27	34,000 B. & W.	Elswick .	Vickers . P.T.	1913	1914	..	9–4 K.S.	2–1	6	6 K.S.	9 K.S.	6 K.S.	14 *12-in.*, 20 *6-in.*, 10 *12-pr.*	3 sub.	22	3200 620	1100
b.	**Ajax** . . *Pl.* 7.	23,000	555	89	27½	28,000 B. & W.	Greenock	Scott . P.T.	1912	1913	1,937,631*	12–6	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*	3	22 *t*	900	900
b.	**Barham** . . *Pl.* 3.	27,500	600	90½	28¾	75,000 B. & W.	Clydeb'nk	J. Brown B.C.T.	1914	1915	..	13–6	3–1	6	4–2	10	6	8 *15-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	25	Oil 2800	925
b.	**Bellerophon**[1] .	18,600	490	82	27	23,000 B. & W.	Portsm'th	Fairfield . P.T.	1907	1909	1,765,342*	11–6–4 K.C.	..	8	..	11 K.C.	..	10 *12-in*, 16 *4-in.*, 4 *3-pr* & M.	3	21·80 *t*	900	780
b.	**Benbow** . . *Pl.* 4.	25,000	580	90	28	29,000 B. & W.	Dalmuir .	Beardmore P.T.	1913	1914	2,027,115*	12–8	1–2½	9–8	1–1½	10	6	10 *13·5-in*, 12 *6-in.*, 4 *3-pr.* 2 A.A.	4	21	3250 1050 Oil	828
b.	**Centurion** . *Pl.* 7.	23,000	555	89	27½	28,200 Y²	Devonp'rt	Hawthorn P.T.	1911	1913	1,939,648*	12–6	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*	3	22 *t*	900	900
b.	**Collingwood** .	19,250	500	84	27	24,500 Y²	Devonp't	Hawthorn P.T.	1908	1910	1,731,640*	10–6–4	¾–1¾	8	..	9	.	10 *12-in.*, 18 *4-in.*, 4 *3-pr.*, 5 M.	3	21·5 *t*	900	724
b.	**Colossus** . .	20,000	510	85	27	25,000 B. & W.	Greenock	Scott . P.T.	1910	1911	1,672,663*	11–3	2½	8	..	11	..	10 *12-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	21·5 *t*	900	780
b.	**Conqueror** . *Pl.* 7.	22,500	545	88½	27½	29,835 B. & W.	Dalmuir .	Beardmore P.T.	1911	1912	1,885,295*	12	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	22·12	900 2700	800
b.	**Emperor of India** . *Pl.* 4.	25,000	580	90	28	29,000 Y.	Barrow .	Vickers . P. T.	1913	1914	2,020,017*	12–8	1–2½	9–8	1–1½	10	6	10 *13·5-in.*, 12 *6-in.*, 4 *3-pr.*, 2 A.A.	4	21	3250 1050 Oil.	828
b.	**Erin** (*ex* Reshadieh) *Pl.* 6.	22,940	525	91½	28½	26,500	Barrow .	Vickers . P.T.	1913	1914	..	12–4 K.C.	3	9–8	12	8	10	10 *13·5-in.*, 16 *6-in.*, 6 *6-pr.*, 2 *3-in.*, 2 M., 4 A.A.	4 (sub.)	21·5	2000 700 Oil.	900

b.	**Hercules** .	20,000	510	85	27	25,700 Y²	Jarrow	Palmer P.T.	1910	1911	1,660,950*	11–8	2½	8	..	11	..	10 *12-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	21·5 *t*	900	780
.c.	**Hood** *Pl.* 1.	41,200	810	104	28½	144,000	Clydeb'k	J. Brown .	1918	1920	5,610,568*	12–6	3–1	7–5	5–4	15–11	..	8 *15-in.*, 12 *5·5-in.*, 4 *4-in.* A.A.	4 (deck) 2 (sub.)	31	4000 1200 Oil	1433
b.	**Iron Duke** . *Pl.* 4.	25,000	580	90	28	29,000 B. & W.	Portsm'th	Cammell Laird P.T.	1912	1914	2,080,918	12–8	1–2½	9–8	1–1½	10	6	10 *13·5-in.*, 12 *6-in.*, 4 *3-pr.* 2 A.A.	4	21 *t*	3250 1050 Oil	828
b.	**King George V.** . *Pl.* 7.	23,000	555	89	27½	28,005 B. & W.	Portsm'th	Parsons P.T.	1911	1912	1,965,413*	12–6	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*	3	22 *t*	900	900
b.c.	**Lion** . *Pl.* 12.	26,350	660	88½	28	75,685 Y²	Devonport	Vickers P.T.	1910	1912	2,086,458*	9	..	6	..	9	..	8 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	2	28·5 *t*	3000	980
b.	**Malaya¶** . *Pl.* 3.	27,500	600	90½	28¾	75,000 B. & W.	Walker .	Wallsend . P. T.	1915	1916	..	13–6	3–1	6	4–2	10	6	8 *15-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	25	Oil 3400	925
b.	**Marlborough** . *Pl.* 4.	25,000	580	90	28	29,000 Y²	Devonport	Hawthorn P.T.	1912	1914	2,043,437	12–8	1–2½	9–8	1–1½	10	6	10 *13·5-in.*, 12 *6-in.*, 4 *3-pr.*, 2 A.A.	4	21 *t*	3250 1050 Oil	828
b.	**Monarch** . *Pl.* 7.	22,500	545	88½	27½	28,555 Y²	Elswick .	Hawthorn. P. T.	1911	1912	1,886,912*	12	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*	3	21·88 *t*	900 2700	800
b.	**Neptune** .	19,900	510	85	27	27,721 Y²	Portsm'th	Harland & Wolff † P.T.	1909	1911	1,715,258*	11–8	2½	8	..	11	..	10 *12-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	21·78 *t*	900	780
b.c.	**New Zealand‡** . *Pl.* 13.	18,800	555	80	26½	46,894 B. & W.	Govan .	Fairfield . P.T.	1911	1912	(‡)	..	..	..	..	..	..	8 *12-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	2	25	1000	780
b.	**Orion** . *Pl.* 7	22,500	545	88½	27½	29,108 B. & W.	Portsm'th	Wallsend . P. T.	1910	1911	1,918,773*	12	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	21·02 *t*	900 2700	800
b.c.	**Princess Royal** . *Pl.* 12.	26,350	660	88½	28	76,510 Y²	Barrow .	Vickers P.T.	1911	1912	2,092,214*	9	..	6	..	9	..	8 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	2	28·5 *t*	3000	980
b.	**Queen Elizabeth** . *Pl.* 3.	27,500	600	90½	28¾	75,000 B. & W.	Portsm'th	Wallsend . P.T.	1913	1915	..	13–6	3–1	6	4–2	10	6	8 *15-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	25	Oil 3400	925
b	**Ramillies** .	25,750	590	88½	28½	40,000 Y.	Dalmuir .	Beard- more, P.T.	1916	1917	..	13–6	4–1	6	6–4	11	6	8 *15-in.*, 14 *6-in.*, 4 *3-pr.*, 2 A.A.	4	23	3420 Oil	915
b.	**Resolution** *Pl.* 2.						Jarrow .	Palmer . P.T.	1915	1916												

¹ Not included in post-war fleet.

* Total estimated cost of ship including guns.

† By arrangement with John Brown & Co.

‡ Built at the charge of the New Zealand Government.

¶ Built at the charge of the Federated Malay States.

GREAT BRITAIN.—Armoured Ships—*continued.*

ss.	NAME.	Displacement.	Length.	Beam.	Draught.	Horse-Power.	Where Built.	Maker of Engines	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Fuel.	Complement.
												Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position. Heavy Guns.	Gun Position. Second-ary.	Guns	Torpedo Tubes.		Coal. / Oil.	
		tons.	ft.	ft.	ft.						£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	**Revenge**	25,750	580	88½	28½	40,000 Y.	Barrow	Vickers P.T.	1915	1916	..	13–6	4–1	6	6–4	11	6	8 *15-in.*, 14 *6-in.*, 4 *3-pr.*, 2 A.A.	4	23	3420 Oil.	915
b.	**Royal Oak**						Devonp'rt	Hawthorn P.T.	1914	1916												
b.	**Royal Sovereign** *Pl.* 2.						Portsm'th	Parsons P.T.	1915	1916												
b.c.	**Renown**	26,500	750	90	25½	112,000 B. & W.	Govan	Fairfield B.C.T.	1916	1916	..	6–3 K.C.	2	6–3	4–3	9–7 K.C.	6 K.C.	6 *15-in.*, 17 *4-in.*, 1 & 2 *3-in* A.A.	2	32	4250 Oil.	950
b.c.	**Repulse** *Pl.* 8.						Clydeb'nk	J. Brown B.C.T.	1916	1916												
b.	**St. Vincent**	19,250	500	84	27	24,500 B. & W.	Portsm'th	Scott's S. P.T.	1908	1910	1,754,615*	10	¾–1¾	8	..	9	..	10 *12-in.*, 18 *4-in.*, 4 *3-pr.*, 5 M.	3	21·9 *t*	900	780
b.	**Superb**¹	18,600	490	82	27	23,000 B. & W.	Elswick	Wallsend P. T.	1907	1909	1,660,446*	11-8-4 K.C.	..	8	..	11 K.C.	..	10 *12-in.*, 16 *4-in.* B.L., 4 *3-pr.*, 5 M.	3	21·6 *t*	900	870
b.	**Temeraire**					23,000 Y²	Devonp'rt	Hawthorn. P. T.	1907	1909	1,748,955*									22·07 *t*		
b.	**Thunderer** *Pl.* 7.	22,500	545	88½	27½	27,604 B. & W.	Blackwall	Thames Ironworks P. T.	1911	1912	1,889,920*	12	..	9	..	10	..	10 *13·5-in.*, 16 *4-in.*, 4 *3-pr.*, 5 M.	3	21	900 / 2700	800
b.c.	**Tiger** *Pl.* 11.	28,500	660	90½	28½	108,000 B. & W.	Clydeb'nk	J. Brown B. C. T.	1913	1914	2,500,000*	9–3	3–1	6	4–2	9	6	8 *13·5-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	30	3320 / 900	1110
b.	**Valiant** *Pl.* 8.	27,500	600	90½	28¾	75,000 B. & W.	Govan	Fairfield B. C. T.	1914	1916	..	13–6	3–1	6	4–2	10	6	8 *15-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	25	Oil 3400	925
b.	**Warspite** *Pl.* 8.	27,500	600	90½	28⅝	75,000 B. & W.	Devonp'rt	Hawthorn P.T.	1913	1915	..	13–6	3–1	6	4–2	10	6	8 *15-in.*, 12 *6-in.*, 4 *3-pr.*, 5 M., 2 A.A.	4	25	Oil 3400	925

¹ Not included in post-war fleet.

* Total estimated cost of ship, including guns.

The foregoing 31 battleships and 7 battle-cruisers represent the present material strength of the fighting Navy as regards its main types. In their disposition of ships, the Admiraly have not drawn a distinct line between effective and non-effective vessels, but have more or less divided them into three catagories—first, those required for the post-war Fleets, or likely to be required; secondly, those not so required, but which may be of use for subsidiary services; and thirdly, ships not required for any further service, which have been, or will be, placed on the sale list. The vessels in the above table include only those in the first category.

The following is a list of the ships in the second category: Agamemnon, battleship, Fleet target service; Antrim, cruiser, signal and wireless experimental ship; Carnarvon, cruiser, seagoing training ship for special entry cadets: and Commonwealth, battleship, seagoing gunnery ship for qualifying gunlayers; the Temeraire, battleship, which is at present used as a training ship for cadets, is retained in the first category, with her sister-ships the Bellerophon and Superb.

The principal ships in the third category are now the battleships Dreadnought, Lord Nelson, Dominion, Hibernia, Hindustan and Zealandia; the battle-cruisers Indomitable and Inflexible; and the cruisers Shannon, Achilles; and vessels of the Devonshire and Kent classes.

Monitors.

The list of 87 monitors and coast defence ships which appeared in the 1919 Annual is not reprinted, as all these vessels have been removed from the post-War Fleet as fighting units. Those retained for the present on subsidiary duties are:—Marshal Soult, Erebus, and Terror, gunnery firing tenders at Devonport, Chatham, and Portsmouth respectively; and the Marshal Ney, used as a hulk in place of the Arrogant as tender to the Submarine Depôt at Portsmouth.

River Gunboats.

Two classes of river gunboats have been added to the Navy during the war. The first class has a displacement of 640 tons, length 230 ft., beam 36 ft., draught 4 ft., H.P. 2000, speed 14 knots, armament, two 6-in., two 12-prs., six M.; fuel capacity, coal 35, oil 54 tons. Names:—Aphis, Bee, Cicala, Cockchafer, Cricket, Glowworm, Gnat, Ladybird, Mantis, Moth, Scarab and Tarantula. Particulars of the smaller class are:—Displacement 98 tons, length 120 ft., beam 20 ft., draught 2 ft., H.P. 175, speed 10 knots, armament, one 4-in., one 12-pr., one 2-pr. A.A.; fuel capacity, coal 5, oil, 10 tons. Names:—Firefly, Butterfly, Cranefly, Dragonfly, Gadfly, Grayfly, Greenfly, Mayfly, Sawfly, Blackfly, Caddisfly, and Hoverfly. The Mayfly has been lent to the War Office since January, 1918.

GREAT BRITAIN.—Cruising Ships, &c.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Horse-Power.	Where Built.	Maker of Engines.	Date of Launch.	Date of Completion.	Cost.	Armour. Belt. / Deck.	Armour. Gun Position.	Armament. Guns.	Armament. Torpedo Tubes.	Speed.	Fuel. Coal. / Oil.	Complement.
		tons	ft.	ft.	ft.						£	in.	in.			knots.	tons.	
S C. .	**Argus** .	..	565	68	22¾	20,000	Dalmuir .	Beardmore	1917	1918	..	..	..	4 *4-in.* A.A., 2 *4-in.* Q.F.	.	20¾	..	..
P. L. Cr. .	**Inconstant**	3500	410	39	14	40,000	Dalmuir	Beardmore P.T.	1914	1914	289,000*	3	..	2 *6-in.*, 6 *4-in.* Q.F., 1 *4-in.* A.A., 1 M.	4	30	840 Oil.	270
P. L. Cr. .	**Galatea** .						Dalmuir	Beardmore P.T.	1914	1914								
P. L. Cr. .	**Penelope** .						Barrow .	Vickers . P.T.	1914	1914								
P. L. Cr. .	**Phaeton** .						Barrow .	Vickers . P.T.	1914	1915								
P. L. Cr. .	**Royalist** .						Dalmuir	Beardmore P.T.	1915	1915								
P. L. Cr. .	**Undaunted**						Govan .	Fairfield . B.C.T.	1914	1914								
P. L. Cr. .	**Birkenhead**	5250	430	48	15	25,000	Birkenhead	Cammell Laird	1915	1915	300,000*	..	..	10 *5·5-in.* . . .	..	25	Coal. Oil.	400
P. L. Cr. .	**Chester** .					31,000	Birkenhead	Cammell Laird	1915	1916						26·5	Oil.	400
Cr. . .	**Birmingham** .	5440	430	49·10	15·10	26,500	Elswick .	Hawthorn.	1912	1914	353,437*	..	..	9 *6-in.*, 4 *3-pr.* . .	2	25·5	650	400
,, . .	**Bristol** . .	4800	430	47	15¼	24,529 Y.	Clydeb'nk	J. Brown . C.T.	1910	1910	364,953*	2–¾	..	2 *6-in.*, 10 *4-in.* B.L., 4 M.	2	26·84	650	376
L. Cr. .	**Courageous**	18,600	735	81	22·3	90,000 Y.	Walker . (Armstr'g)	Parsons .	1916	1916	..	3	9–7	4 *15-in.*, 18 *4-in.*, 3 *3-in.* A.A., 5 M.	2 12	32	Oil 3250	785
,, .	**Glorious** . *Pl. 9.*						Belfast .	Harland & Wolff										
S. C. .	**Furious** . *Pl. 10.*	19,100	735	88	21·6	90,000	Walker (Armstrong)	Wallsend Engn'g Co.	1916	1917	1,920,000†	3	7	2 *18-in.*, 8 *5·5-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 5 M. (*a*)	2 16	31·5	Oil 3400	725

P. L. Cr.	Calliope .	3750	420	41	13·6	40,000	Chath'm	Parsons . P.T.	1914	1915	..	3	..	2 *6-in.*, 8 *4-in.* ‡ .	4	29	Oil 900	287
" " .	Caroline .						Birken-head	Cammell Laird P.T.	1914	1914								
" " .	Carysfort .						Pembroke	Hawthorn. B.C.T.	1914	1915								
" " .	Champion						Newcastle (Hawth'rn)	Hawthorn. P.T.	1914	1915								
" " .	Cleopatra .						Devonport	Cammell Laird P.T.	1914	1915								
" " .	Comus .						Newcastle (Swan Hunter)	Wallsend Engn'g Co. P.T.	1914	1915								
" " .	Conquest .						Chatham	Scotts' . P.T.	1914	1915								
" " .	Cordelia . *Pl.* 18.						Pembroke	Hawthorn. P.T.	1914	1915	..	3	..	2 *6-in.*, 8 *4-in.* ‡ .	..	29	Oil 900	287
" " .	Cairo .	4190	425	43·6	14·6	40,000	Birken-head	Cammell Laird	1918	1919	..	3	..	5 *6-in.*, 2 *3-in.* A.A. .	8	29	Oil 900	287
" " .	Calcutta .						Barrow .	Vickers .	1918	1919								
" " .	Cape Town						Birken-head	Cammell Laird	1919	..								
" " .	Carlisle .						Govan .	Fairfield .	1918	1918								
" " .	Colombo *Pl.* 18.						Govan .	Fairfield .	1918	1919								
" " .	Caledon .	4120	425	42·9	14·6	40,000	Birken-head	Cammell Laird	1916	1917	300,000	3	..	5 *6-in.*, 2 *3-in.* A.A. .	8	29	Oil 900	287
" " .	Calypso .						Glasgow	Scotts' .	1917									
" " .	Caradoc . *Pl.* 18.						Barrow .	Vickers .	1916									
" " .	Cambrian .	3750	420	41·6	14·6	40,000	Pem-broke	..	1915	1916	300,000†	3	..	5 *6-in.*, 2 *3-in.* A.A. .	4	29	Oil 900	287
" " .	Canterbury						Clyde-bank	J. Brown .	1915	1916								
" " .	Castor .						Birken-head	Cammell Laird	1915	1915								
" " .	Constance. *Pl.* 18.						Birken-head	Cammell Laird	1915	1916								

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* Total estimated cost of ship including guns.

† Estimated cost as originally designed.

‡ Some of the vessels of this class have all 6-in. armament.

(*a*) Primary armament taken out when ship converted to a plane carrier.

GREAT BRITAIN.—Cruising Ships, &c.—*continued.*

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Horse-Power.	Where Built.	Maker of Engines.	Date of Launch.	Date of Completion.	Cost.	Armour. Belt. Deck.	Armour. Gun Position	Armament. Guns.	Armament. Torpedo Tubes.	Speed.	Fuel. Coal. Oil.	Complement.
		tons.	ft.	ft.	ft.						£	in.	in.			knots.	tons.	
L. Cr.	**Cardiff**	4190	425	43·6	14·6	40,000	Govan	Fairfield	1917	1917	..	3	..	5 *6-in.*, 2 *3-in.* A.A.	8	29	Oil 900	287
„	**Ceres**						Clydebank	J. Brown	1917	1917								
„	**Coventry**						Newcastle (Swan Hunter)	Swan Hunter	1917	1918								
„	**Curacoa**						Pembroke	..	1917	1918								
„	**Curlew** *Pl.* 18.						Barrow	Vickers	1917	1917								
„	**Centaur**	3750	420	42	13·6	40,000	Elswick	Armstrong	1915	1916	300,000†	3	..	5 *6-in.*	4	29	Oil 900	287
„	**Concord** *Pl.* 18.						Elswick	Armstrong										
Cr.	**Chatham**	5400	430	49¾	15¾	25,901 Y.	Chatham	Thames Ironworks P.T.	1911	1912	349,358*	3 –	..	8 *6-in.*, 4 *3-pr.*, 4 M., 1 l.	2	25·5	650	400
„	**Dartmouth**	5250	430	48½	15½	23,467 Y.	Barrow	Vickers P.T.	1911	1911	329,406*	2–¾	..	8 *6-in.*, 4 *3-pr.*, 4 M.	2	25·9 t	650	390
P. L. Cr.	**Despatch**	4750	445	46	14·3	40,000	Govan	Fairfield	1919	..	..	3	Shields	6 *6-in.*, 2 *3-in.* A.A.	12	29	Oil 1050	340
„	**Diomede** *Pl.* 17.						Barrow	Vickers	1919	..								
„	**Danae**	4750	445	46	14·3	40,000	Elswick	Armstrong	1918	1918	..	3	Shields	6 *6-in.*, 2 *3-in.* A.A.	12	29	Oil 1050	340
„	**Dauntless**						Jarrow	Palmer	1918	1918								
„	**Dragon** *Pl.* 17.						Green'ck	Scott	1917	1918								

L. Cr.	**Delhi**	4750	445	46	14·3	40,000	Elswick	Armstrong	1918	1919	..	3	Shields	6 *6-in.*, 2 *3-in.* A.A.	12	29	Oil 1050	340
"	**Dunedin**						Elswick	Armstrong	1918	1919								
"	**Durban** *Pl.* 17.						Green'ck	Scott	1919	..								
Cr.	**Dublin**	5400	430	49·10	15¾	25,000 Y.	Dalmuir	Beardmore P. T.	1912	1913	337,565*	3 –	..	8 *6-in.*, 1 *12-pr.*, 4 *3-pr.*, 4 M., 1 l.	2	25·5	650	400
S.C.	**Eagle,** *ex* Almirante Cochrane.	26,200	625	92	27	55,000	Walker	J. Brown	1918	1920	..	..	..	..	..	24	..	..
P. L. Cr.	**Effingham**	9750	565	65	17·3	60,000 70,000	Portsmouth	Harland & Wolff	..	..	750,000†	3	Shields	7 *7·5-in.*, 6 *3-in.*, Q.F., 4 *3-in.*, A.A.	6	30	1500 800 Oil	480
"	**Frobisher**						Devonport	Wallsend Eng'g Co.	1920	..								
"	**Hawkins**						Chatham	Parsons Co.	..	1919								
"	**Raleigh** *Pl.* 15.						Dalmuir	Beardmore	1919	1920								
P. L. Cr.	**Enterprise**	7550	545	54½	16½	80,000	Clydebank	John Brown	1919	..	..	3–1½ 1	..	7 *6-in.*, 2 *4-in.* A.A.	12	32·88	1600 650 Oil	556
"	**Emerald**						Elswick	Armstrong	1920	..	..							
"	**Glasgow**	4800	430	47	15¼	22,472 *t*	Govan	Fairfield P. T.	1909	1910	354,884*	2–¾	..	2 *6-in.*, 10 *4-in.*, 1 *12-pr.*, 4 *3-pr.*	2	25·8 *t*	650	376
"	**Gloucester**					23,757 *t*	Dalmuir	Beardmore P. T.			353,856*					26·29 *t*		
S. C.	**Hermes**	10,400	548	70	18	40,000	Elswick	Parsons Co.	1919	..	..	..	..	10 *5·5-in.*, 4 *4-in.* A.A.	..	25	2000	630 §
P. L. Cr.	**Liverpool**	4800	430	47	15¼	24,614 Y.	Barrow	Vickers P.T.	1909	1910	344,871*	2–¾	..	2 *6-in.*, 10 *4-in.* B.L., 4 *3-pr.*	2	26·17 *t*	650	376
Cr.	**Lowestoft**	5440	430	49	15	22,000	Chatham	Fairfield	1913	1914	375,162	..	..	9 *6-in.*, 4 *3-pr.*	2	25·5	650	..

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* Total estimated cost of ship, including guns.

† Estimated cost as originally designed.

§ 500 Naval ratings, and 130 R.A.F. Personnel.

GREAT BRITAIN.—Cruising Ships, &c. - *continued.*

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse Power.	Where Built.	Maker of Engines.	Date of Launch.	Date of Completion.	Cost.	Armour. Belt. / Deck.	Armour. Gun Position.	Armament. Guns.	Armament. Torpedo Tubes.	Speed.	Fuel. Coal. Oil.	Complement.
		tons.	ft.	ft.	ft.						£	in.	in.			knots.	tons.	
P. L. Cr.	**Newcastle**	4800	430	47	15¼	24,669 Y.	Elswick	Wallsend Engineering Co. P.T.	1909	1910	352,610*	2–¾	..	2 *6-in.*, 10 *4-in.* B.L., 4 *3-pr.*	2	26·26 *t*	650	376
Cr.	**Southampton**	5400	430	49·10	15¾	25,000 Y.	Clydeb'nk	J. Brown C.T.	1912	1913	336,469*	3 / –	..	8 *6-in.*, 4 *3-pr.*, 4 M., 1 l.	2	25·5	650	400
S. C.	**Vindictive** *ex* Cavendish *Pl.* 16.	..	605	65	20·4	60,000	Belfast	Harland & Wolff	..	1918	..	..	..	4 *7·5 in.*, 4 *3-in.*, Q.F., 4 *3-in.*, A.A.	6	..	..	..
,,	**Weymouth**	5250	430	48½	15½	22,000 Y.	Elswick	Parsons P. T.	1910	1911	337,738*	2¾	..	8 *6-in.*, 4 *3-pr.*, 4 M.	2	25·5 *t*	650	390
,,	**Yarmouth**						Glasgow	London & Glas. Co. C. T.	1911	1912	358,238*							

* Total estimated cost of ship, including guns.

The above list of cruising ships on the effective list includes all vessels from the Bristol class of 1909–10. The classes struck out as non-effective are the Boadicea, Sentinel and Topaze groups, and older vessels such as the Fox and Amphitrite. The cruisers on subsidiary duties include the Hermione, parent-ship in Southampton water; and Highflyer, flagship of the Commander-in-Chief in the East Indies. There are a number of other vessels on the effective list which are being used for various purposes as repair ships, 'plane carriers, mine sweepers and other auxiliary work, including depôt ships for destroyers and submarines.

Defence Forces of the Dominions.

ROYAL AUSTRALIAN NAVY.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Maker of Engines.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
												Belt. Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.						£	in.	in.			knots.	tons.	
.c.	**Australia** *Pl.* 13.	18,800	555	80	26½	48,000	Clydebank	J. Brown P.T.	1911	1913	..	..	..	8 *12-in.*, 16 *4-in.*, 5 M.	2	26·0 *t*	1000	790
. L. Cr.	**Adelaide**	5400	430	49½	15¾	25,500	Sydney	..	1918	..	..	..	..	8 *6-in.*, 4 *3-pr.*, 4 M., 1 l.	2	25·5	..	..
„ „	**Melbourne**						Birkenhead	Cammell Laird	1912	1913								
„ „	**Sydney**						Glasgow	London & Glasgow Co.	1912	1913								
„ „	**Brisbane**						Sydney	..	1915	1916								
„ „	**Encounter**	5880	355	56	20¼	12,500 Dürr	Devonp'rt	Devonport Dockyard	1903	1906	370,275	3-2	..	11 *6-in.*, 9 *12-pr.*, 1 *3-pr.*, 2 M.	2	20·75	600	454
F. L.	**Anzac**	1660	315	31·9	10	36,000	Dumbarton	Denny	1916	1917	..	..	..	4 *4-in.*, Q.F., 2 *2-pr.*	4	34	515 Oil	..

DESTROYERS.—"*River*" *Class* :—Huon, Parramatta, Swan, Torrens, Warrego, Yarra. Launched, 1910–15; Displacement, 700 tons; 9,500–11,300 H.P.; speed, 27 knots; armament, one 4-in., three 12-pdrs., three tubes.

"*S*" *Class* :—Stalwart, Success, Swordsman, Tasmania, Tattoo. Launched, 1918–19; Displacement, 1,250 tons; 27,00 H.P.; speed, 36 knots; armament, three 4-in., one 2-pdr., 6 tubes (4 21-in., 2 18-in.).

SUBMARINES.—"*J*" *Class* :—J 1, J 2, J 3, J 4, J 5, J 7. Launched, 1916–18; Displacement, surface, 1,210 tons, submerged, 1,820 tons; H.P., surface, 3,600, submerged, 1,350; speed, surface, 19 knots, submerged, 9½ knots; oil fuel, 91 tons; armament, one 3-in. or 4-in., six 18-in. tubes.

The Royal Australian Navy also includes the Cerberus, turret-ship, Platypus, submarine depôt ship, Pioneer, light cruiser, and several old cruisers and sloops which were lent for service during the war, as well as certain armed patrol vessels taken up for the same purpose.

ROYAL CANADIAN NAVY.

LIGHT CRUISER.—"*Arethusa*" *Class* :—Aurora. Completed, 1914 (Devonport Dockyard and Parsons Co.). Displacement, 3,500 tons; 40,000 H.P.; speed, 30 knots; armament, two 6-in., six 4-in. Q.F., one 4-in. A.A., one M., four 21-in. tubes; oil, 840 tons; complement, 270.

DESTROYERS.—"*M*" *Class* :—Patrician and Patriot. Completed, 1916 (Thornycroft). Displacement, 980 tons; 26,500 H.P.; speed, 35 knots; armament, three 4-in., two 1½-pdrs., four 21-in. tubes; oil, 256 tons (radius of action, 1,510 at 15 knots).

SUBMARINES.—"*H*" *Class* :—H 4, H 15. Surface displacement, 440 tons, submerged, 500; surface H.P., 480, submerged, 320; surface speed, 13 knots, submerged, 10½ knots; oil fuel, 16 tons; armament, four 21-in. tubes.

The Royal Canadian Navy has no effective ships of the larger classes, the cruisers Niobe and Rainbow, which were lent for training purposes, being ordered in March, 1920, to be paid off for sale. There are other small craft used for miscellaneous and special service during the war.

ARGENTINE REPUBLIC.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
a.c.	**Garibaldi** . .	6732	328	59¾	24	13,384	Sestri Ponente	1895	1896	752,000	6–3 H.S.	1½	6 H.S.	6 H.S.	6 H.S.	6 H.S.	2 *10-in.*, 10 *6-in.*, 6 *4·7-in.*, 4 *2·2-in.*, 2 M.	2	19·9 *t*	1000	500
a.c.	**General Belgrano** .	7069	328	59¾	24	13,000	Leghorn .	1897	1899	696,700	6–3 H.S.	1½	6 H.S.	6 H.S.	6 H.S.	6 H.S.	2 *10-in.*, 14 *6-in.*, 2 *3-in.*, 4 *2·2-in.*, 2 L., 2 M.	4	20·1 *t*	1000	500
a.c.	**General San Martin**	6773	328	59¾	24	13,000	Leghorn .	1896	1898	688,200	6–3 H.S.	1½	6 H.S.	6 H.S.	6 H.S.	6 H.S.	4 *8-in.*, 10 *6-in.*, 6 *4·7-in.*, 4 *2·2-in.*, 2 L., 2 M.	4	19·8	1100	500
b.	**Moreno** . . **Rivadavia** . *Pl.* 19.	27600	585	98	27½	39,500 B. & W. Curtis t.	Camden, N.J. (N.Y.S.B.Co.) Quincy, Mass.	1911	1914	2,200,000	12–10 K.S.	3–2	9–6 K.S.	9 K.S.	12–9 K.S.	6 K.S.	12 *12-in.*, 12 *6-in.*, 16 *4-in.*, 10 smaller.	2 sub.	22·5 *t*	1600 4000	1046
a.c	**Pueyrredon** . .	6773	328	59¾	24	13,000 B.	Sestri Ponente	1898	1901	782,000	6–3 H.S.	1½	6 H.S.	5 H.S.	6 H.S.	6 H.S.	2 *10-in.*, 10 *6-in.*, 6 *4·7-in.*, 4 *2·2-in.*, 2 M.	4	20·1 *t*	1000	500

The old coast-defence ironclads Libertad and Independencia, 2336 tons, completed at Birkenhead in 1892–93, carry two 9·4-in., four 4·7-in., and four 3-pr. guns.

Cruisers Buenos Aires (Elswick, 1895), 4780 tons, two 8-in., four 6-in., six 4·7 in., three T.T., 23·2 knots on trial; river gunboats Patria (1894), 1070 tons, two 4·7 in., eight smaller, five T.T., Paraná and Rosario (Elswick, 1909), 1000 tons, two 6-in. howitzers, six 12-pr., twelve smaller, 15 knots. For destroyers, see Flotilla Tables.

The training-ship (cruiser) Presidente Sarmiento, 2750 tons; also the old cruiser Nueve de Julio, 3570 tons, Elswick 1902, and several small gunboats and torpedo-gunboats.

A programme is in contemplation for considerable reorganisation and the augmentation of the resources of the Navy, the improvement of the shore establishments, and the building or acquisition of scout cruisers, destroyers, submarines, training and hospital ships, transports and auxiliaries, but nothing has been done except in the building of transports.

BRAZIL.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal	Complement.
											Belt.	Deck.	Side above Belt.	Bulkheads.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
c.d.s., t.	**Marshal Deodoro**	3112	267½	48	13¼	3400 D'A.	La Seyne	1898	1900	..	13¾–4 H.S.	1½	..	..	8 H.S.	3 H.S.	2 *9·4-in.*, 4 *4·7-in.*, 2 M., 4 *6-pr.*, 2 *1-pr.*	2 (sub.)	15·0	236	200
c.d.s., t.	**Marshal Floriano**							1899	1901												
b.	**Minas Geraes** . *Pl.* 20.	19,281	500	83	25	27,212 *t* B.&W.	Elswick	. 1908	1909	1,821,400	9–6–4 K.S.	2	9–6–4 K.S.	9	12–8 K.S.	9 K.S.	12 *12-in.*, 22 *4·7-in.*, 8 *3-pr.*	4	21·4 *t*	900 2400	900
b.	**São Paulo** . *Pl.* 20.	19,281	500	83	25	28,645 *t* B.&W.	Barrow	. 1909	1910	1,821,400	9–6–4 K.S.	2	9–6–4 K.S.	9 K.S.	12–8 K.S.	9 K.S.	12 *12-in.*, 22 *4·7-in.*, 8 *3-pr.*	4	21·6 *t*	900 2400	900

Also river monitors Maranhao and Pernambuco, built at Rio de Janeiro.

LIGHT CRUISERS:—Bahia and Rio Grande do Sul, completed at Elswick, 1910, 3100 tons, ten 4·7-in., eight 1·8-in. guns, 17,000 H.P., 27 knots; Barroso (Elswick, 1897), 3600 tons, six 6-in., four 4·7-in. guns, 20 knots. Four 12-knot river gunboats, Missões, Acre and two others (Poplar, 1907). Carlos Gomes, mine-layer.

CHILE.—Armoured Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position. Heavy Guns.	Gun Position. Second-ary.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			kts.	tons.	
b	Almirante Latorre (*ex* Canada) *Pl.* 21.	28,000	625	92	28½	37,000 Y 2	Elswick	1913	1915	..	9–4 A.I.	4–2½	4½	..	10	6	10 *14-in.*, 14 *6-in*, 6 *3-in.* and M.	4 sub.	23	3300 520	1000
a.c.	O'Higgins	8,500	411¾	62½	22	16,000 B.	Elswick	1897	1898	..	7–5	2	..	..	7½–6	6	4 *8-in.*, 10 *6-in.*, 4 *4·7-in.*, 10 *12-pr.*, 10 *6-pr.*, 4 M.	8 (2 sub.)	21·5 *t*	1260	500
b.	Capitan Prat	5,981	328	60¾	21¾	12,000	La Seyne	1890	1893	391,000	12	3	4	..	10½	2	4 *9·4-in.* (Canet), 8 *4·7-in.* (Canet), 10 *12-pr.*, 14 smaller and M.	4	18·3 *t*	775	480
a.c.	Esmeralda	7,020	436	53¼	22¼	16,000	Elswick	1896	1897	..	6 H.S.	2	..	6 H.S.	4½ Shields	..	2 *8-in.*, 16 *6-in.*, 8 *12-pr.*, 2 *3-pr.*, 4 M.	3	22·8 *t*	1350	500

Capitan Prat reconstructed.

Cruising Ships, &c.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.						in.	in.			knots.	tons.	
cr	Blanco Encalada	4400	370	46½	18½	14,500	Elswick	1893	1894	..	4–1¾	..	2 *8-in.*, 10 *6-in.*, 12 *3-pr.*, 10 *1-pr.**	5	22·78 *t*	900	427
,,	Chacabuco	4500	360	46	18	15,750	Elswick	1901	1903	..	4½–1¾	..	2 *8-in.*, 10 *4·7-in.*, 16 *1·8-in.*, 2 M., 1 l.	5	23·0	1000	350
,,	General Baquedano (Training)	2330	240	45¾	18	1500 B.	Elswick	1898	1900	..	..	..	4 *4·7-in.*, 2 *12-pr.*, 2 *6-pr.*, 2 M., 1 l.	1	13·7 *t.*	300	302
,,	Ministro Zenteno	3600	330¼	43¾	16¾	6500	Elswick	1896	1898	..	..	..	8 *6-in.*, 10 *6-pr.*, 4 *1-pr.**	8	20·0*t*	800	280
,,	Presidente Errázuriz	2047	268	35¾	19½	5400	La Seyne	1890	1892	..	3½	..	4 *6-in.* (Canet), 2 *5-in.*, 4 *2·2-in.*, 6 M.	3	19·0	200	171

* Armstrong.

Transports: Maipo, 11,000 tons; Rancagua, 10,000 tons; Angamos, 5,000 tons; Aguila, 600 tons; Porvenir, 800 tons. Sloops or patrol vessels: Orompello, Leucoton, [illegible] Yelcho, Huemul, Condor, 100 to 250 tons.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Fuel.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
c.d.s.,t.	**Herluf Trolle**	3595	271	50	16¼	4400 T.	Copenhagen	1899	1901	..	7–4 H.S.	3	..	..	7 H.S.	6 H.S.	2 *9·4-in.*, 4 *5·9-in.*, 6 *12-pr.*, 2 *6-pr.*	3 (sub.)	16 5	250	250
c.d.s.,t.	**Niels Juel**	4100	295	53½	15¾	5500	Copenhagen	1918	..	..	7–4 K.S.	2	..	7	..	10 K.S.	10 *5·9-in.*, 3 *6-pr.*	2 (sub.)	17	Oil	250
c.d.s.,t.	**Olfert Fischer**	3650	271	50	16¼	4600	Copenhagen	1903	1905	..	7–4 K.S.	3	..	..	7 K.S.	6	2 *9·4-in.*, 4 *5·9-in.*, 6 *12-pr.*, 2 *6-pr.*	3 (sub.)	16·0	250	250
c.d.s.,t.	**Peder Skram**	3735	274¼	51½	16¼	5400	Copenhagen	1908	1909	..	8–4 K.S	2	..	..	7 K.S.	6 K S.	2 *9·4-in.*, 4 *5·9-in.*, 10 *14-pr.*, 2 *1-pr.*	4	16·0	250	250
c.d.s.,t.	**Skjold**	2200	226½	38	13½	2400 T.	Copenhagen	1896	1899	..	10–3 H.S.	2	..	7	8	5½	1 *9·4-in.*, 3 *4·7-in.* (K.), 4 *6-pr.*	4	13·0	280	210

Cruising Ships, &c.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.				tons.	
3rd cl. *cr.*	**Geiser**	1280	232	34	11¼	3600 T.	Copenhagen	1892	1893 1907	..	1½	..	2 *4·7-in.*, 4 *20-pr.*, 4 *6-pr.*	2	17·1 *t*	150	155
"	**Heimdal**	1313	232	34	11¾	3100 T.	Copenhagen	1894	1896	..	1½	..	2 *4·7-in.*, 4 *20-pr.*, 4 *6-pr.*, 6 M.	2	17·5	150	155

Heimdal, used as officers' training ship. Valkyrien (3020 tons), reconstructed 1913, training ship. Mine-layers Lossen, Hjalperen, Beskytteren, Minekrau V., Minekrau VI. Fylla (ex-British sloop Asphodel), and 4 other fishery inspection cruisers. Groensund, submarine repair ship, Hekla submarine depôt. Three surveying ips.

FRANCE.—Armoured Ships.

The five battleships Béarn, Flandre, Gascogne, Languedoc and Normandie, 25,230 tons, twelve 13·4-in. guns, 21 knots, all launched, have been removed from the list. There is no likelihood of their being completed.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
a.c.	**Aube** (Amiral) .	9637	453	66¼	24½	22,155 *t.* B.	St. Nazaire	1902	1904	973,440	6–4 H.S.	2	5–2 H.S.	..	7½ H.S.	6½–5 H.S.	2 7·6-*in.*, 8 6·4-*in.*, 6 3·9-*in.*, 20 small Q.F. and M.	2 (sub.)	21·9 *t*	970 1590	615
b.	**Bretagne** . . *Pl.* 23.	23,177	546	88½	29	29,000 tur.	Brest .	1913	1915	2,589,439	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	10 13·4-*in.*, 22 5·5-*in.*, 8 small Q F. and M.	4 (sub.)	20·0	900 2700	1167
a.c	**Condé** . .	10,397	453	63¾	24½	22,175 Nic.	Lorient .	1902	1904	863,799	6–4 H.S.	2	5–2 H.S.	..	7½ H.S.	6½–5 H.S.	2 7·6-*in.*, 8 6·4-*in.*, 6 3·9-*in.*, 18 1·8-*in.*	2 (sub.)	21·4 *t*	970 1590	615
b.	**Condorcet**. . *Pl.* 25.	18,890	481	84	27	22,500 N. tur.	St. Nazaire	1909	1911	2,165,200	10–8 K.S.	2¾	8¾	..	12 K.S.	8¾ K.S.	4 12-*in.*, 12 9·4-*in.*, 16 12 *pr.*, 8 3-*pr.*, 2 1-*pr.*	2 (sub.)	19·8 *t*	960 2010	690
b.	**Courbet** . . *Pl.* 24.	23,100	546	88½	29	28,000 N. tur.	Lorient .	1911	1913	2,508,388	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	12 12-*in.*, 22 5·5-*in.*, 4 3-*pr.*	4 (sub.)	20·0	900 2700	998
b.	**Démocratie** . *Pl.* 25.	14,635	444	79½	27½	19,190 B.	Brest .	1904	1907	1,473,180	11–7 H.S.	2¾	8 H.S.	..	12 H S.	6 H.S.	4 12-*in.*, 10 7·6-*in.*, 28 1·8-*in.*	2 (sub.)	19·44 *t*	905 1285	793
a.c.	**Desaix** . shd.	7578	433	58¼	24¼	17,860 *t* B.	St. Nazaire	1901	1903	762,759	4–3 H.S.	2¾	..	..	3½ H.S.	..	8 6·4-*in.*, 4 3·9-*in.*, 10 3-*pr.*	2	21·7 *t*	880 1200	531
b.	**Diderot** . *Pl.* 25.	18,863	476	84	27	22,500 N. tur.	St. Nazaire	1909	1911	2,167,000	10–8 K.S.	2¾	8¾	..	12 K.S.	8¾	4 12-*in.*, 12 9·4-*in.*, 16 12-*pr.*, 8 3-*pr.*, 2 1-*pr.*	2 (sub.)	19·75 *t*	960 2010	690
a.c.	**Edgard Quinet**	14,100	521	70¼	27½	39,803 *t* B.	Brest .	1907	1911	1,307,536	6½–3½ K.S.	2½–1¼	5–2 K.S	4¾ K.S.	8 K S.	4¾ K.S.	14 7·6-*in.*, 20 2·4-*in.*, 2 smaller.	2 (sub.)	23·9 *t*	1242 2300	738
a.c.	**Ernest Renan** . *Pl.* 26.	13,427	515	70½	26¾	37,500 Nic., *t*	St. Nazaire	1906	1909	1,410,000	6¾–4 H.S.	2	5–3 H.S.	4¾	6 H.S.	5 H.S	4 7·6-*in.*, 12 6·4-*in.*, 16 9-*pr.*, 8 3-*pr.*	2 (sub.)	25·5 *t*	1354 2300	674

b.	**France** . *Pl.* 24.	23,100	546	88½	29	28,000 N. tur.	St. Nazaire	1912	1916	2,603,920	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	12 *12-in.*, 22 *5·5-in.*, 4 *3-pr.* Q.F. and M.	4 (sub.)	20·0	900 2700	998
a.c.	**Gloire** .	10,376	460	66	25½	20,500 Nic.	Lorient .	1900	1904	883,269	6–4 H.S.	2	5–2 H.S.	..	7½ H.S.	6½–5 H.S.	2 *7·6-in.*, 8 *6·4-in.*, 6 *3·9-in.*, 16 *1·8-in.*, 6 *1·4-in.*	2 (sub.)	21·0	970 1580	615
a.c	**Gueydon** .	9367	459	63¾	24½	20,200 Nic	Lorient .	1899	1902	817,994	6–3¾ H.S.	2	3¾ H.S.	6 H.S.	6 H.S.	3¾ H.S.	2 *7·6-in.*, 8 *6·4-in.*, 18 *3-pr*	2 (sub.)	21·0	1020 1600	610
b.	**Jean Bart** *Pl.* 24.	23,467	546	88½	29	28,000 B. tur.	Brest .	1911	1913	2,528,888	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	12 *12-in.*, 22 *5·5-in*, 4 *3-pr.*	4 (sub.)	22·0	900 2700	998
a.c.	**Jeanne d'Arc** .	11,300	489¼	63¾	26½	29,690 Guyot	Toulon .	1899	1903	875,847	6–3 H.S.	2·2	3 H.S.	..	6 H.S.	5 H.S.	2 *7·6-in.*, 14 *5·5-in.*, 16 *3-pr.*, 8 *1·4 in.*, 2 M.	2 (sub.)	21·7 *t*	1400 2000	626
„	**Jules Ferry** *Pl.* 26.	12,351	487	70¼	27	30,500 Guyot	Cherbourg	1903	1906	1,169,940	6¾–4 H.S.	2	5–3 H.S.	6	6 H.S.	5 H.S.	4 *7·6-in.*, 16 *6·4-in.*, 2 *9-pr.*	2 (sub.)	22·8 *t*	1320 2100	728
„	**Jules Michelet** .	13,370	489½	70¼	27	27,700 Guyot	Lorient .	1905	1908	1,204,107	6–4 K.S.	2	5–3 K.S.	6 H.S.	8 K.S.	5 K.S.	4 *7·6-in.*, 12 *6·4-in.*, 2 *9-pr.*	2 (sub.)	23·2 *t*	1320 2100	724
b.	**Justice*** . *Pl.* 25.	15,099	443	79½	27½	18,548 Nic. *t.*	La Seyne .	1904	1907	1,670,385	11–7 H.S.	2¾	8 H.S.	..	12 H.S.	6 H.S.	10 *7·6-in.*, 13 *2·5-in.*, 10 *3-pr.*	2 (sub.)	19·43 *t*	905 1825	793
b.	**Lorraine** . *Pl.* 23.	23,549	546	88½	29	29,000 tur. S. & cyl.	St. Nazaire	1913	1915	2,642,439	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	10 *13·4-in.*, 22 *5·5-in.*, 4 *3-pr.*, 2 *1-pr.*	4 (sub.)	20·0	900 2700	1167
a.c.	**Marseillaise** .	9611	460	66	25½	21,500 B.	Brest .	1900	1903	881,270	6·4 H.S.	2	5–2 H.S.	..	7½ H.S.	6½–5 H.S.	2 *7·6-in.*, 8 *6·4-in.*, 6 *3·9-in.*, 2 *2·5-in.*, 18 *1·8-in.*, 6 *1·4-in.*	2 (sub.)	21·0	970 1590	615
a.c.	**Montcalm** .	9367	459	63¾	24½	19,600 N.S.	La Seyne .	1900	1902	902,809	6 H.S.	2	3¾ H.S.	6 H.S.	6 H.S.	2¾ H.S.	2 *7·6-in.*, 8 *6·4-in.*, 4 *3·9-in.*, 16 *3-pr.*	2 (sub.)	21·0	1020 1600	612
b.	**Paris** . *Pl.* 24.	23,467	546	88½	29	28,000 N. tur.	La Seyne .	1912	1914	2,603,920	11–7 K.S.	2¾–1¾	7 K.S.	7 K.S.	10½ K.S.	7 K.S.	12 *12-in.*, 22 *5·5-in.*, 4 *3-pr.*, Q. F. & M.	4 (sub.)	20·0	900 2700	998
b.	**Patrie*** .	15,141	444	79½	27½	17,859 *t.*Nic.	La Seyne .	1903	1906	1,674,870	11–7 H.S.	2¾	8 H.S.	..	12 H.S.	6 H.S.	18 *6·4-in.*, 13 *1·8-in.*, 10 *1·4-in.*	2 (sub.)	19·12 *t*	905 1825	793

* The four 12-in. guns of the Justice, Patrie and République have been removed.

FRANCE.—Armoured Ships—*continued.*

Class.	NAME.	Displacement.	Length	Beam.	Draught	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.				Armament.				Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	**République***	14,635	444	79½	27½	19,626 *t.*Nic.	Brest	1902	1906	1,523,136	11–7 H.S.	2¾	8 H.S.	..	12 H.S.	6 H.S.	18 *6·4-in.*, 13 *1·8-in.*, 10 *3-pr.*	2 (sub.)	19·15	905 1825	793
b.	**Vergniaud** *Pl.* 25.	18,890	481	84	27	22,500 N. tur.	Bordeaux	1910	1911	2,165,200	10–8 K.S.	2¾	8¾	..	12 K.S.	8¾ K.S.	4 *12-in.*, 12 *9·4-in.*, 16 *12-pr.*, 8 *3-pr.*, 2 *1-pr.*	2 (sub.)	19·67 *t*	960 2010	690
b.	**Vérité** *Pl.* 25.	14,635	444	79½	27½	20,433 *t.* B.	Bordeaux	1907	1908	1,661,409	11–7 H.S.	2¾	8 H.S.	..	12 H.S.	6 H.S.	4 *12-in.*, 10 *7·6-in.*, 13 *1·8-in.*, 10 *3-pr.*	2 (sub.)	19·26 *t*	905 1825	822
a.c.	**Victor Hugo** *Pl.* 26.	12,351	480½	70¼	27	28,486 *t.* B.	Lorient	1904	1907	1,229,932	6¾–4 H.S.	2	5–3 H.S.	6	8 H.S.	5 H.S.	4 *7·6-in.*, 16 *6·4-in.*, 22 *1·8-* 2 *1·4-in.*	2 (sub.)	22·5 *t*	1320 2100	728
b.	**Voltaire** *Pl.* 25.	18,754	481	84	27	22,500 B. tur.	La Seyne	1909	1911	2,169,200	10–8 K.S.	2¾	8¾	..	12 K.S.	8¾ K.S.	4 *12-in.*, 12 *9·4-in.*, 16 *12-pr.*, 8 *3-pr.*, 2 *1-pr.*	2 (sub.)	20·66 *t*	960 2010	690
a.c.	**Waldeck-Rousseau**	14,220	515	70¼	27½	35,286 Nic. *t.*	Lorient	1908	1911	1,301,380	6½–3½	2½	5	4¾	6	5½	14 *7·6-in.*, 20 *2·4-in.*, 3 *3-pr.*, 2 *1-pr.*	2 (sub.)	23·10 *t*	1242 2300	738

* République, 12-in. guns removed.

The battleships Henri IV., Mirabeau and Saint Louis, and the armoured cruiser Dupleix recently removed from the effective list. The old battleships Jauréguiberry, Brennus, Carnot, Charlemagne, and Charles Martel, and the armoured cruisers Bruix, Dupetit-Thouars, Kléber, were previously removed from the lists.

Requin, 7214 tons, 2 10·8-in. and smaller guns, gunnery school ship; Pothuau, 5374 tons, training ship; Latouche-Tréville, 4681 tons, tender to gunnery ship.

Class.	NAME.	Displacement.	Length	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
. cr.	**Cassard** . . .	3890	325½	45	20½	10,143 D'A.	Cherbourg .	1896	1898	318,712	3	2 shield	6 *6·4-in.*, 4 *3·9-in.*, 10 *3-pr.*	2	19·8 *t*	630	385
„	**Colmar** (*ex*-Kolberg).	4280	402	46	16½	30,000 *t* (tur.)	Danzig (Schichau)	1908	1910	380,870	..	2	6 *5·9-in.*, 4 *3·4-in.* (Rearmed 1916).	2 (sub.)	26·3 *t*	890	379
„	**D'Entrecasteaux** shd.	8123	394	58½	25¾	14,500	La Seyne .	1896	1898	667,740	4	10–3 H.S.	2 *9·4-in.*, 12 *5·5-in.*, 12 *3-pr.*	2 (sub.)	19·2 *t*	650	521
„	**D'Estrées** . shd.	2460	311¾	39¼	17¾	8500 Nor.	Rochefort .	1897	1900	208,200	1½	..	2 *5·5-in.*, 5 *3·9-in*, 8 *3-pr.*	..	20·5 *t*	345 480	234
„	**Du Chayla** . shd.	3957	325½	45	22	10,009 D'A.	Cherbourg .	1895	1897	315,835	3	2 shield	6 *6·4-in.*, 4 *3·9-in.*, 8 *3-pr.*	2	20·2 *t*	624	385
„	**Guichen** . . shd.	8282	436¼	54¾	24½	25,500 D'A.	St. Nazaire .	1897	1899	611,945	2½	2 shield	2 *6·4-in.*, 6 *5·5-in.*, 12 *3-pr.*	..	23·5	1460 2000	625
„	**Jurien de la Gravière** shd.	5690	449	43½	23	18,400 Guyot	Lorient . .	1899	1901	475,979	3	..	8 *6·4-in.*, 10 *3-pr.* . .	2 (sub.)	22·9 *t*	5600 11,000	511
„	**Metz** (*ex*-Königsberg)	4200	450†	45	16	45,000	Bremen (Weser)	1915	1916	—	4–2½	1	7 *5·9-in.*, 3 *3·4-in.* A.A., 2 M.	4 (sub.)	28·5	1400	500
„	**Mulhouse** (*ex* Stralsund)	4480	446¼†	43½	15¾	35,515 *t* (tur.)	Bremen (Weser)	1912	1913	416,340	4–2½	2	7 *5·9-in.*, 2 *3·4-in.* A.A., 2 M. (Rearmed)	2 (sub.)	28·27 *t*	1200	378
„	**Strasbourg** *Pl.* 31. (*ex*-Regensburg)	4842	456†	45	17	26,000 (P. tur.)	Bremen (Weser)	1914	1915	417,810	4–2½	2	7 *5·9-in.*, 2 *3·4-in.* A.A., 2 M. (Rearmed)	2 (sub.)	27·5	1279	373
„	**Thionville** (*ex*-Novara)	3500	416¾	42	15½	25,000 (tur.)	Fiume . .	1913	1914	..	1	..	9 *3·9-in.*, 4 smaller . .	1	27·0	450 850	320

† Water-line.

The surrendered German cruisers are the Strasbourg, Metz, Mulhouse, and Colmar. The Thionville is the *ex*-Austrian Novara. In addition is the *ex*-German flotilla leader 113. The surrendered airship L72 has received the name of Dixmude.

During the war thirty-four 15- and 17-knot despatch vessels of 351 tons were built: the Algol, Altaïr, Aldebaran, Antarès, Bellatrix, Cassiopée, Régulus, Quentin-Roosevelt, ubordieu, Dumont d'Urville, Du Couedic, Du Chaffault, Duperré, Ancre, Oilette, Arras, Bapaume, Escaut, Marne, Oise, Somme, Coucy, Bar le Duc, Nancy, Amiens, Aisne, carpe, Suippe, Yser, Tahure, Dunkerque, Toul, Ville d'Ys and Meuse. Twenty-one others are in hand. In addition are the older cruisers Descartes and Lavoisier, as well as veral other gun-vessels and river gunboats.

Mine-layers Pluton and Cerbère, 560 tons, 6000 I.H.P., 20 knots. Converted mining vessels, Cassini, 966 tons; Flamberge, 300 tons. Nine converted mine-sweepers, and venty-eight new ones. Submarine chasers ninety-nine (internal combustion engines), sixteen (coal). Foudre, 5984 tons, and Campines, depôt ships for balloons and seaplanes.

MERCHANT AUXILIARY CRUISERS.—La France, 22,500 register tons, 235 knots, Touraine, 8429 register tons, 19·5 knots, Lorraine, 11,869 register tons, 21 knots, Savoie, 11,200 gister tons, 22½ knots, of the Compagnie Générale Transatlantique, and some other vessels; also the Amazone, Magellan, Tonkin, and other 17 and 17½ knot boats of the ries Maritimes, and the Burdigala, 18 knots, and Lutetia, 20·5 knots, of the Sud Atlantique line.

GERMANY.

In the following list the letter **A** implies that the ships so marked are to be retained in reserve with their armament, but to have no ammunition on board.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	. **Braunschweig** .	12,997	398½	73½	24½	16,000 T.S. & C.	Germania .	1902	1904	1,157,500	9–4 K.S.	3	6 K.S.	6 K.S.	10–6 K.S.	6 K.S.	4 *11-in.*, 14 *6·7-in.*, 18 *3·4-in.*, 4 M.	6 (sub.)	18·0	700 1600	660
b.	. **Elsass** . . .	12,997	398½	72¾	24½	16,812 W.T.& C.	Danzig (Schichau)	1903	1905	1,157,500	9–4 K.S.	3	6 K.S.	6 K.S.	10–6 K.S.	6 K.S.	4 *11-in.*, 14 *6·7-in.*, 18 *3·4-in.*, 4 M.	6 (sub.)	18·7	800 1600	660
b.	. **Hannover** . .	13,040	398½	73¾	25¼	22,492 T.S. *t.*	Wilhelmshaven	1905	1907	1,157,500	9½–4 K.S.	3	8 K.S.	6 K.S.	10–6 K.S.	6¾ K.S.	4 *11-in.*, 14 *6·7-in.*, 20 *3·4-in.*, 4 *1·4-in.*, 4 M.	6 (sub.)	19·16 *t*	700 1800	736
b.	. **Hessen** . . .	12,997	398½	73¾	24½	16,000 T.S. & C.	Kiel (Germania)	1903	1905	1,157,500	9–4 K.S.	3	6 K.S.	6 K.S.	10–6 K.S.	6 K.S.	4 *11-in.*, 14 *6·7-in.*, 18 *3·4-in.*, 4 M.	6 (sub.)	18·0	800 1600	743
b.	**A** **Lothringen** . .	12,997	398½	73¾	24½	16,950 W.T.&C.	Schichau (Danzig)	1904	1906	1,157,500	9–4 K.S.	3	6 K.S.	6 K.S.	10–6 K.S.	6 K.S.	4 *11-in.*, 14 *6·7-in.*, 18 *3·4-in.*, 4 M.	6 (sub.)	18·54 *t*	800 1600	600
b.	**A** **Preussen** . . .	12,997	398½	73¾	24½	18,374 W.T.& C.	Stettin .	1903	1905	1,157,500	9–4 K.S.	3	6 K.S.	6 K.S.	10–6 K.S.	6 K.S.	4 *11-in.*, 14 *6·7-in.*, 12 *3·4-in.*, 12 *1 4-in.* & 8 M.	6 (sub.)	18·6 *t*	1574 1600	660
b.	. **Schlesien** . .	13,040	398½	72¾	25¼	16,939 T.S. & C.	Schichau Germania	1906	1908	1,214,000	9½–4 K.S.	3	8 K.S.	6 K.S.	11–6 K.S.	6¾ K.S.	4 *11-in.*, 14 *6·7-in.*, 20 *3·4-in.*, 4 *1·4*, 4 M.	6 (sub.)	19·2 19·5 *t*	700 1800	736
b.	. **Schleswig-Holstein**																				

Light cruisers **Medusa**, **Thetis**, and **Amazone** (2630 tons), completed 1901; **Arkona**, 1903; **Hamburg**, 1904; **Berlin**, 1905, all mounting ten *4·1-in.* guns. Also **Nymphe** and **Niobe** (1899, 1901), these two to retain armament, but to have no ammunition on board.

Twelve destroyers: T. 185, 190, 196 (older type); V. 2, 3, 5; G. 7, 8, 10, 11; S. 18, 23 (1911–14). Twelve torpedo-boats: I. 90, 101–110, 118. Also destroyers V. 6, I. 170, 175, S. 19 (4), and torpedo-boats I. 85, 86, 88, 89 (4) to retain armament, but to have no ammunition on board.

GREECE.—Armoured Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position. Heavy Guns.	Gun Position. Second-ary.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
a.c.	**Giorgios Averoff** *Pl. 27.*	9956	429¾	68¾	24¾	20,000 B	Leghorn (Orlando)	1910	1911	1,100,000	8–3½ K.S.	1¾	7	7	7–6	..	4 *9·2-in.*, 8 *7·5-in.*, 16 *3-in.*, 8 *1·8-in.*	3 (sub.)	24·0	700 1600	..
b.	**Hydra** . . .	4808	334½	51¾	23¼	7000	St. Nazaire La Seyne .	1889	1891 1900	..	11¾-4	2½	3	..	13½	..	3 *10·6-in.* Canet, 5 *5·9-in.*, 1 *3·9-in.*, 8 *2·5-in.*, 4 *1·8-in.*, 12 *1·4-in.*	3	17·0	600	400
b. *b.*	**Kilkis** (*ex* Mississippi) **Lemnos** (*ex* Idaho) *Pl. 27.*	13,000	375	77	24¾	13,607 B.&W.	Philadelphia	1905	1908	616,360	9–4 K.S.	3½–1 K.S.	7 K.S.	7 K.S.	10–7½ K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *7-in.*, 12 *3-in.*, 6 *3-pr.*, 10 smaller	2 (sub.)	17·1 *t.*	600 1750	725
b.	**Psara** . . .	4808	334½	51¾	23¼	7000	Havre . . La Seyne .	1890	1892 1897	..	11¾-4	2½	3	..	13½	..	3 *10·6-in.* Canet, 5 *5·9-in.*, 1 *3·9-in.*, 8 *2·5-in.*, 4 *1·8-in.*, 12 *1·4-in.*	3	17·0	600	400
b.	**Spetsai** . .	4808	334½	51¾	23¼	7000	Havre . . La Seyn .	1889	1891 1900	..	11¾-4	2½	3	..	13½	..	3 *10·6-in.* Canet, 5 *5·9-in.*, 1 *3·9-in.*, 8 *2·5-in.*, 4 *1·8-in.*, 12 *1·4-in.*	3	17·0	600	400

GREECE.—Cruising Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
cr.	Helli (*ex* Fei-Hung)	2600	330	42	13	6500 tur.	Camden, N.J. .	1912	1914	240,000	¾	..	2 *6-in.*, 4 *4-in.*, 2 *12-pr.*, 6 *3-pr.*	2	22·5	..	..

Torpedo depôt-ship.—Kanaris, 1100 tons, 500 I.H.P., 2 3·9-in. (Krupp) guns, 14 knots speed. Mine-layers Aigialla, Monemvassia, Nauplia. Five old gunboats and four corvettes. The light cruisers Admiral Condouriotis and Lambros Katsonis (5500 tons, 25·5 knots) were taken over for the British Navy at the beginning of the war.

ITALY.—Armoured Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in	ins	ins.	ins.	ins.	ins.			knots.	tons.	
b.	**Andrea Doria**	22,562	575¾	92	29	32,000 P. tur. Y.	Spezia	1913	1915	..	10½–6 K.S.	1¾	6 K.S.	..	9½ K.S.	5 K.S.	13 *12-in.*, 16 *6-in.*, 13 *14-pr.*, 6 *14-pr.* A.A., 6 l.	3 (sub.)	23	1000 2500	1074
b.	**Caio Duilio** *Pl.* 28.						Castellammare	1913	1915												
b.	**Conte di Cavour** *Pl.* 29.	22,023	559¾	92	29	24,000 Parsons B. & W.	Spezia	1911	1915	..	9½–4½ K.S.	1¾	6 K.S.	..	9½ K.S.	5 K.S.	13 *12-in.*, 18 *4·7-in.*, 14 *12-pr.*, 6 l. & M.	3 (sub.)	22 0	1000	999
b.	**Dante Alighieri** *Pl.* 29.	19,400	505	85	27¼	35,000*t* Parsons Bl.	Castellammare	1910	1912	..	9½–4½ K.S.	1½	6 K.S.	..	10 K.S.	..	12 *12-in.*, 20 *4·7-in.*, 13 *12-pr.*	3 (2sub.)	23·8 *t*	1000 2500	900
a.c.	**Francesco Ferruccio**	7294	344	59¾	23¼	13,500 Nic.	Venice	1902	1904	..	6–3 H.S.	1½	6 H.S.	5 H.S.	6 H.S	6 H.S.	1 *10-in.*, 2 *8-in.*, 14 *6-in.*, 10 *2·9-in.*, 6 *1·8-in.*, 2 M.	4 (sub.)	20·0	655 1200	540
b.	**Giulio Cesare** *Pl.* 29.	22,023	557	92	28	34,000 P. B.&W.	Genoa (Ansaldo)	1911	1914	..	9½–4½ K.S.	1¾	6 K.S.	..	9½ K S.	5 K.S.	13 *12-in.*, 18 *4·7-in.*, 14 *12-pr.*, 6 l. & M.	3 (sub.)	23·0 *t*	1000	999
						P. Bl.	Genoa (Odero)	1911	1914												
b.	**Napoli**	12,425	435½	73½	27¼	20,000 B.&W.	Castellammare	1905	1909	1,120,000	9¾–4 H.S.	2	8 H.S.	8 H.S.	8 H.S.	6 H.S.	2 *12-in.*, 12 *8-in.*, 12 *3-in.*, 12 *1·8-in.*	2 (sub.)	22·0	1000 2000	711
b.	**Regina Elena**					20,000 B.	Spezia	1904	1907												
a.c.	**Pisa** *Pl.* 30.	9956	429¾	68¾	24¾	18,000 B.	Leghorn (Orlando)	1907	1909	..	8–3½ K.S.	1¾	7 K.S.	7 K.S.	7–6 K.S.	..	4 *10-in.*, 8 *7·5-in.*, 16 *3-in.*, 2 M.	3 (sub.)	23·0	700 1600	687
b.	**Roma**	12,425	435½	73½	27¼	20,000 B. & W.	Spezia	1907	1909	1,120,000	9¾–4 H.S.	2	8 H.S.	8 H.S.	8 H.S.	6 H.S.	2 *12-in.*, 12 *8-in.*, 12 *3-in.*, 12 *1·8-in.*	2 (sub.)	22·0	1000 2000	711
a.c.	**San Giorgio**	9832	429¾	68¾	24¾	18000 Bl.	Castellammare	1908	1910	..	8–3½ K.S.	1¾	7 K.S.	7 K.S.	7–6 K.S.	7 K.S.	4 *10-in.*, 8 *7·5-in.*, 16 *3-in.*, 8 *1·8-in.*	3 (sub.)	22·5	700 1600	643
a.c.	**San Marco** *Pl.* 30.					18000 tur.															
b.	**Sardegna**	13,640	411	76¾	28½	19,650 *t*	Spezia	1890	1895	1,057,440	4	3	4	2¾	14¼ *comp.*	..	4 *67-ton* (A.), 8 *5·9-in.*, 16 *4·7-in.*, 2 *2·9-in.*, 20 *2·2-in.*, 10 *1·4-in.*, 2 M.	5	20·1 *t*	1200	785
a.c.	**Varese**	7294	344	59¾	23⅓	13,500 B.	Leghorn (Orlando)	1899	1901	..	6–4½ H.S.	1½	6 H.S.	5 H.S.	6 H.S.	6 H.S.	1 *10-in.*, 2 *8-in.*, 14 *6-in.*, 10 *2·9-in.*, 6 *1·8-in.*, 2 M.	4	20·0	650 1200	500
b.	**Vittorio Emanuele III**	12,425	435½	73½	27¼	20,000 B.	Castellammare	1904	1907	1,120,000	9¾–4 H.S.	2	8 H.S.	8 H.S.	8 H.S.	6 H.S.	2 *12-in.*, 12 *8-in.*, 12 *3-in.*, 12 *1·8-in.*	2 (sub.)	22·0	1000 2000	711

For the ships removed from the list, see Ch. II. The armoured cruiser Marco Polo, 4511 tons, completed in 1894, has been converted into a troopship and renamed Cortellazzo. Monitors Faa di Bruno, Carso, Cucco, Monfalcone and Vodice, 1,650 tons, 2 *15-in.*, 4 *14-pr.*, and 6 light guns. The old battleship Sicilia has been converted into a repair ship.

ITALY.—Cruising Ships.

[illegible]	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armaments.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
Scout	**Alessandro Poerio**	1012	279	26¼	9¼	20,000 turb.	Genoa (Ansaldo)	1914	1915	..	..	..	6 *4-in.*, 4 *2-pr.* A.A.	2 dbl.	32·0	400	100
l. cr.	**Ancona** (*ex* German Graudenz) *Pl.* 31.	4842	456	45	17	26,600	Kiel	1913	1914	..	..	..	7 *5·9-in.*, 2 *22-pr.* 2 M.	2 *19·7 in.*	27·5	1279	..
Scout	**Aquila**	1500	310	31	..	..	Genoa (Ansaldo)	1915	1916	..	..	..	3 *6-in.*, 4 *12-pr.* A.A.	4	35·0	350 Oil	160
”	**Augusto Riboty**																
l. cr.	**Campania**	2460	251	41¾	17	4000	Castellammare	1914	1915	..	1	..	6 *6-in.*, 2 *14-pr.*, 3 *14-pr.*, A.A., 2 M.	..	16·5	500	..
”	**Calabria**	2452	249¼	42	16¾	4094 *t*	Spezia	1894	1897	183,120	2	..	6 *4·7-in.*, 10 smaller	2	16·4 *t*	500	257
Scout	**Carlo Mirabello**	1476	331	31·3	..	35,000	Genoa (Ansaldo)	1914	1916	..	..	..	8 *4-in.*, 2 *12-pr.* A.A.	4	35·0	350 Oil	140
”	**Falco**	1460	310	31	..	40,000	Naples (Pattison)	..	1918	..	..	..	3 *6-in.*, 4 *12-pr.* A.A.	2 dbl.	35·0	200	160
”	**Guglielmo Pepe**	1012	279	26¼	9¼	20,000 turb.	Genoa (Ansaldo)	1914	1915	..	..	..	6 *4-in.*, 4 *2-pr.* A.A.	2 dbl.	32·0	400	100
to.g.b.	**Iride**	931	229½	27	10¼	4242	Castellammare	1891	1892	72,920	1	..	1 *4·7-in.*, 6 *2·2-in.*, 3 *1·4-in.*	6	19·6 *t*	120	111
Scout	**Leone**	1985	359	33½	..	24,200	Genoa (Ansaldo)	Bldg.	..	..	..	..	6 *4·7-in.*, 4 *2-pr.* A.A.	2 dbl.	34·0	400	..
l. cr.	**Libia**	3690	341½	47	..	12,500	Genoa (Ansaldo)	1912	1913	..	1½	..	2 *6 in.*, 8 *4·7-in.*, 14 smaller	2	22·0	630	300
”	**Liguria**	2245	262½	39¼	16¾	7677 *t*	Genoa (Ansaldo)	1893	1894	183,120	2	4½	2 *5·9-in.*, 6 *4·7-in.*, 2 *3-in.*, 2 *2·2-in.*, 4 smaller	2	19·6 *t*	430	257

ITALY.—Cruising Ships—*continued*.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Fuel.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
Scout .	**Marsala** . . .	3400	460½	42¾	13¼	22,500 P.tur.Bl.	Castellammare .	1912	..	..	1½	..	6 *4·7-in.* and 6 *12-pr.*, mining equipment	2	28·0	800	240
,,	**Nino Bixio** . .	3400	460¼	42¾	13¼	22,500 Bl.Cur.t.	Castellammare .	1911	1914	..	1½	..	6 *4·7-in.* and 6 *12-pr.*, mining equipment	2	27·7	800	300
,, .	**Pantera** . . .	1012	279	26¼	9¼	20,000	Genoa (Ansaldo) .	1914	1915	..	..	..	6 *4-in.*, 4 *2-pr.* A.A. . . .	2 (dbl.)	32·0	400	100
,, .	**Premuda** . . (*ex* German V. 116)	2500	360	36	14	4500 approx.	Hamburg . .	..	1919	..	..	..	4 *5·9-in.*	4 *23·6 in.*	35	600 Oil.	..
l. cr. .	**Puglia** . . .	2498	269	41	16¾	7000	Taranto. . .	1898	1901	200,000	4½	1	4 *5·9-in.*, 6 *4·7-in.*, 1 *2·9-in.*, 8 *2·2-in.*, 8 *1·4-in.*, 2 M.	2	20·0	650	257
Scout .	**Quarto** . . .	3220	432	42¾	13¼	29,000 P.tur.Bl.	Venice . . .	1911	1912	..	1½	..	6 *4·7-in.* and 6 *12-pr.*, mining equipment	2	28·6	450	240
g.v. .	**Sebastiano Caboto**	800	250	31¾	9	2000	Palermo . .	1912	..	..	..	..	6 *12-pr.*, 4 M.	..	13·0	100	..
Scout .	**Tigre** . . .	1985	359	33½	..	24,200	Genoa (Ansaldo) .	Bldg.	..	..	..	..	6 *4·7-in.*, 4 *2-pr.* A.A. . .	2 (dbl.)	34·0	400	..
l.c. . .	Ex-German **Strassburg**	4480	446¼†	43½	15¾	33,742 *t* P. tur.	Wilhelmshaven .	1912	1912	416,340	4-2½	2	7 *5·9-in.*, 2 *3·4-in.* A.A., 2 M. (Rearmed)	2 (sub.)	28·28 *t*	1200	373
,, . .	Ex-German **Pillau**	4320	441†	46	19½	27,400 T.	Danzig (Schichau) .	1914	1914	..	..	1	8 *5·9-in.*, 2 *3·4-in.* A.A. (Rearmed)	5	27·5	1000	..
,, . . ,, . .	Ex-Austrian **Helgoland** . . . Ex-Austrian **Saida**	3500	416¾	42	15½	25,000 Tur.	Fiume . . Monfalcone .	1912	1914	..	1	..	9 *3·9-in.*, 4 smaller . .	2	27·0	450 850	320

Etna (3474 tons), converted into a training ship. Agordat and Puglia, mining vessels. Coal and liquid fuel transport Bronte (9490 tons). The Carlo Mirabello and Augusto Riboty are fitted to carry 100 mines, and the Aquila and Falco 50 mines each. Anteo, submarine salvage vessel. Lagoon gunboats and mine-layers Brondolo and Marghera, 1900 tons, 17 knots. Surveying vessel, Ammiraglio Magnaghi, 1800 tons, 14 knots. Small vessels, Capitano Verri (*ex*-Thetis) and Bengazi (*ex*-Derna) captured from the Turks.

† Water line.

JAPAN.—Armoured Ships.

ss.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
															Gun Position.						
											Belt.	Deck.	Side above Belt.	Bulkhead.	Heavy Guns.	Second-ary.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.						in.	in.	in	in.	in	in.			knots.	tons.	
.c.	Adzuma . .	9436	431½	59¼	21¾	17,000 B.	St. Nazaire .	1899	1901	..	7–3½ H. S.	3	5 H.S.	..	6 H. S.	6 H.S.	4 *8-in.*, 12 *6-in.*, 12 *3-in.*, 8 *1·8-in.*	5 (4 sub.)	20·0	600 1275	482
c.	Akagi . .	40,000	850	100	..	..	..	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (?)	..	30	..	..
,,	Amagi* .																				
b.	Aki . . . *Pl.* 33.	19,800	460	83½	27½	24,000 My. tur.	Kure . .	1907	1911	..	9–5 K. S.	2–3	8	..	9	6	4 *12-in.*, 12 *10-in.*, 8 *6-in.*, 8 *12-pr.*, 8 l. and M.	5 (sub.)	20·5	..	940
,,	Asahi . . .	14,765	400½	75¼	27½	16,000 B.	Clydebank .	1899	1900	..	9–4 H. S.	4–2½	6 H.S.	12 H.S.	14 H. S.	6 H.S.	4 *12-in.*, 14 *6-in.*, 20 *12-pr.*, 8 *3-pr.*, 4 *2½-pr.*	4 (sub.)	18	700 1549	750
a.c.	Asama . .	9885	408	67	24½	19,000 *t.*	Elswick .	1898	1899	..	7–3½ H. S.	2	5 H.S.	..	6	6 H.S.	4 *8-in.*, 14 *6-in.* (A.), 12 *12-pr.*, 8 *2½-pr.*	5 (4 sub.)	22·1 *t*	600 1409	482
,,	Aso (*ex* Bayan) .	7726	443	55¾	22	17,400 My. *t.*	La Seyne .	1900	1902	..	8–3 K.S.	2	3 K.S.	..	7 K.S.	3 K.S.	2 *8-in.*, 8 *6-in.*, 22 small, l., and M.	2 (sub.)	22 *t*	750 1032	570
b.	Fuji . . .	12,649	374	73	26½	14,000	Thames	1896	1897	..	18–6 H. S.	4–2½	4 H.S.	..	14 H. S.	6 H.S.	4 *12-in.*, 10 *6-in.*, 20 *3-pr.*, 4 *2½-pr.*	5 (4 sub.)	18·2 *t*	700 1100	600
b.	Fuso . .	30,600	630	94	28½	40,000 tur.	Kure .	1914	1915	..	12 K.S.	3	6 K.S.	..	12 K.S.	6 K.S.	12 *14-in.*, 20 *5·5-in.*, 4 *12-pr.* 3 A.A.	6 (sub.)	23	..	..
b.	Hyuga . *Pl.* 32.	31,260	640				Nagasaki (Mitsubishi)	1917	1918												
b.c.	Haruna .	27,500	653½	92	27½	64,000 My. P. t. My. C. t.	Kobe . . (Kawasaki)	1913	1916	..	8–6 K.S.	2¾	..	..	10 K.S.	..	8 *14-in.*, 16 *6-in.*, 18 smaller and M.	8 (sub.)	27·5	1000 4000	1100
,,	Hiyei . . *Pl.* 35.						Yokosuka .	1912	1915												
b.	Hizen (*ex* Retvizan)	12,700	374	72¼	25	16,000 My.	Philadelphia	1900	1902	..	9–4 K.S.	4	6-2 K.S.	9 K.S.	10 K.S.	5 K.S.	4 *12-in.*, 12 *6-in.*, 20 *3-pr.*, 6 *1-pr.*	2	18·0	800 2000	778
.c.	Ibuki . . .	14,620	450½	75½	26¼	27,000 My. tur.	Kure . .	1907	1909	..	7–4 K.S.	2	5 K.S.	..	9 K.S.	..	4 *12-in.*, 8 *8-in.*, 14 *4·7-in.*, 3 *1·8-in.*, 2 l., 4 M.	3 (sub.)	22	600 2000	820
,,	Idzumo .	9750	400	68½	24½	17,300 B. *t.*	Elswick	1899	1900	..	7–3½ H.N.S.	2½	5 H.N.S.	..	6 H. N.S.	6 H.N.S.	4 *8-in.*, 14 *6-in.*, 12 *12-pr.*, 8 *2½-pr.*	4 (sub.)	22·0	600 1412	672
,,	Iwate . .							1900	1901										21·7 *t*		

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* Two others are in the programme, Atako and Takao. Details uncertain.

JAPAN.—Armoured Ships—*continued.*

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position. Heavy Guns.	Gun Position. Second-ary.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
a.c.	**Ikoma** . .	13,750	440	75	26	22,670 My.	Kure .	1906	1908	..	7–5 K.S.	1½	..	..	7 K.S.	..	4 *12-in.*, 12 *6-in.*, 12 *4·7-in.*, 2 *1·8-in.*, 2 l., 4 M.	3 (sub.)	21·0	600 2000	817
b.	**Ise** . . *Pl.* 32.	31,260	640	94	28¾	45,000 P. tur.	Kobe . (Kawasaki)	1916	1917	..	12 K.S.	3	6 K.S.	..	12 K.S.	6 K.S.	12 *14-in.*, 20 *5·5-in.*, 4 *12-pr.*, 3 A.A.	6 (sub.)	23·0	..	..
b.	**Iwami** (*ex* Orel) .	13,516	376	76	26	16,000 My.	Petrograd (Galerny)	1902	1904	..	9–4 K.S.	2½–1½	6 K.S.	9 K.S.	10 K.S.	6 K.S.	4 *12-in.*, 6 *8-in.*, 24 *3-in.*, and smaller.	3 (2 sub.)	18·0	800 2000	740
b.	**Kaga** * . . .	40,600	700	..	..	..	Kobe (Kawasaki)	Bldg.	..	..	..	.	..	..	..	..	8 *16-in*, 20 *5·5-in.*, 4 *12-pr.* A.A.	..	23·5	..	..
b.	**Kashima** . . *Pl.* 34.	16,400	425	78⅙	27	17,280 Nic.	Elswick .	1905	1906	..	9–4 K.S.	3–2½	6	6	9 K.S.	6 K.S.	4 *12-in.*, 4 *10-in.*, 12 *6-in.*, 12 *12-pr.*, 3 *3-pr.*, 6 M., 2 l.	5 (sub.)	19·2 *t*	750 2150	980
a.c.	**Kasuga** .	7630	344	59¾	24¼	14,900	Sestri Ponente	1902	1904	760,000	6 H. N.S.	1½	6 H. N.S.	6 H. N.S.	6 H. N.S.	6 H. N.S.	1 *10-in.*, 2 *8-in.*, 14 *6-in.*, 10 *3-in.*, 6 *1·8 in.*, 2 M.	4	20·0	600 1150	500
b.	**Katori** . . *Pl.* 34.	15,950	420	78	27	18,500 *t*, Nic.	Barrow .	1905	1906	..	9–5 K.S.	3–2	6	6	10 K.S.	6 K.S.	4 *12-in.*, 4 *10-in.*, 12 *6-in.*, 10 *12-pr.*, 3 *3-pr.*, 6 M., 2 l.	5 (sub.)	19·5 *t*	750 1800	980
b.c.	**Kirishima** . . *Pl.* 35.	27,500	653½	92	27½	64,000 My P. t.	Nagasaki . (Mitsubishi)	1913	1916	..	8–6 K.S.	2¾	..	..	10 K.S.	..	8 *14-in.*, 16 *6-in.*, 18 smaller and M.	8 (sub.)	27·5	1100 4000	1100
”	**Kongo** . . *Pl.* 35.	27,500	653½	92	27½	64,000 Y. P. t.	Barrow .	1913	1913	2,500,000	8–6 K.S.	2¾	..	..	10 K.S.	..	8 *14-in.*, 16 *6-in.*, 5 M., 16 smaller	8 (sub.)	27·5	1100 4000	1100
a.c.	**Kurama** . .	14,620	450½	75½	26¼	27,000 My.	Yokosuka .	1907	1911	..	7–4 K. S.	2	5 K.S.	..	9 K. S.	..	4 *12-in.*, 8 *8-in.*, 14 *4·7-in.*, 3 *1·8-in.*, 2 l., 4 M.	3 (sub.)	21·2	600 2000	820
b.	**Mikasa** . .	15,362	400	76	27¼	16,431 B.	Barrow .	1900	1902	..	9–4 H.N.S.	3	6 H. N.S.	12 H. N.S.	14 H. N.S.	6 H. N.S.	4 *12-in.*, 4 *10-in.*, 10 *6-in.*, 20 small	4 (sub.)	18·5 *t*	700 1520	935

c.d.	**Mishima** (*ex* Seniavine)	4792	265	52½	17	5000 My.	Petrograd	1894	1895	410,000	10	..	..	..	7–8	..	4 *10-in.*, 4 *4·7-in.*, 6 *1·8-in.*, 8 M.	4	16·0	400	318
b.	**Mutsu** *	40,600	700	..	..	..	Yokosuka	1919	..	..		..	..	..	..	..	8 *16-in.*, 20 *5·5-in.*, 4 *12-pr.* A.A.	..	23·5	..	..
b.	**Nagato**						Kure														
a.c.	**Nisshin**	7630	344	59¾	24¼	13,500	Sestri Ponente	1903	1904	760,000	6 H. N.S.	1½	6 H. N.S.	6 H. N.S.	6 H. N.S.	6 H. N.S.	4 *8-in.*, 14 *6-in.*, 10 *3-in.*, 6 *1·8-in.*, 2 M.	4	20·0	600 1150	500
c.d.	**Okinoshima** (*ex* Apraxine)	4126	277½	52½	17½	5757 *t.*	Petrograd (New Admiralty)	1896	1898	..	10 H. S.	3	..	..	7¾ K. S.	..	3 *10-in.*, 4 *4·7-in.*, 12 *1·8-in.*, and smaller	4	15·0 *t*	215	318
b.	**Satsuma** *Pl.* 34.	19,350	450	83½	27½	19,370 My.	Yokosuka	1906	1910	..	9–5 K. S.	2–3	8		9	6	4 *12-in.*, 12 *10-in.*, 12 *4·7-in.*, 4 *12-pr.*, 8 l. and M.	5 (sub.)	18·5	750 2860	940
b.	**Settsu** *Pl.* 33.	20,800	500	84	27	26,500 tur.	Yokosuka	1911	1912	..	12–9½ K.S.	2½	9 K.S.	..	12 K.S.	6 K.S.	12 *12-in.*, 10 *6-in.*, 8 *4·7-in.*, 16 small, l. and M.	5 (sub.)	20·5	900 2500	960
b.	**Shikishima**	14,850	400	75¼	27½	16,355 B.	Thames	1898	1899	..	9–4 H.N.S.	4–2½	6 H. N.S	12 H. N.S.	14	6 H. N.S.	4 *12-in.*, 14 *6-in.*, 20 *12-pr.*, 8 *3-pr.*, 4 *2½-pr.*, 8 M.	5 (4 sub.)	18·3	700 1722	741
b.	**Suwo** (*ex* Pobieda)	12,674	401¼	71½	26	14,500 My.	Petrograd (Baltic)	1900	1901	..	9½–4 H. S.	2¾	9 H. S.	9 H. S.	9 H. S.	6 H.S.	4 *10-in.*, 10 *6-in.*, 22 *12-pr.*, and smaller	2 (sub.)	18·0	800 2056	732
a.c.	**Tokiwa**	9850	448	67	24½	20,556 *t.*	Elswick	1898	1899	..	7–3½ H. S.	2	5 H.S.	..	6 H. S.	6 H.S.	4 *8-in.*, 14 *6-in.* (A.), 12 *12-pr.*, 8 *2½-pr.*	5 (4 sub.)	21·0	600 1409	500
b.	**Tosa** *	40,600	700	..	..	..	Kure	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.*, 20 *5·5-in.*, 4 *12-pr.* A.A.	..	23·5	..	..
a.c.	**Yakumo**	9850	407¾	64¼	23¾	16,000 B.	Stettin	1899	1901	..	7–3½ H. S.	2½	5 H.S.	..	6 H. S.	6 H.S.	4 *8-in.* (A.), 12 *6-in.*, 12 *12-pr.* (A.), 8 *2½-pr.*	5 (4 sub.)	20·0	600 1100	500
b.	**Yamashiro** *Pl.* 32.	31,000	658	94	28½	45,000 tur.	Yokosuka	1915	1917	..	12 K.S.	3	6 K.S.	..	12 K.S.	6 K.S.	12 *14-in.*, 16 *6-in.*, 4 *12-pr.* 3 A.A.	6 (sub.)	22·5	..	..

* Particulars uncertain.

N.B.—The battleship Kawachi was blown up in Tokugama Bay, July 12, 1918, and the battle-cruiser Tsukuba in Yokosuka Harbour, January 14, 1917. The old battleship Tango (*ex* Poltava), 10,960 tons, 4 12-in. and 12 6-in. guns, completed at Petrograd 1898, and captured in the hostilities with Russia, was employed in the war. The battleship Sagami (*ex* Peresviet), captured in the war of 1904–5, was retroceded to Russia; also the cruiser Soya (*ex* Varyag).

For the shipbuilding programme see Ch. II.

JAPAN.—Cruising Ships, &c.

lass.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
l.cr.	**Akashi**	2800	295¼	41¾	16½	8500	Yokosuka	1897	1898	327,000	2	4½ shield	2 *6-in.* (A.), 6 *4·7-in.*, 10 *3-pr.*, 2 *2½-pr.*, 4 M.	2	20·0	200 544	300
t.g b.	**Chihaya**	1250	273	31½	10	5500 Nor.	Yokosuka	1900	1901	..	..	..	2 *4·7-in.*, 4 *12-pr.*	2	21·0	123 344	170
l.cr.	**Chikuma**	4950	440	46½	16¾	22,500 Cur. t. My.	Sasebo	1911	1912	..	2¼	..	8 *6-in.*, 4 *3-in.*, 4 M.	3 (sub.)	26	500 1000	390
„	**Chitose**	4992	395	49	18	15,500	San Francisco	1898	1899	205,200	4½	4½ shield	2 *8-in.*, 10 *4·7-in.*, 12 *12-pr.*, 6 *2½-pr.*	4	22·5	350 1000	405
„	**Hirato**	4950	440	46½	16¾	22,500 P. tur. My.	Kobe	1911	1912	..	2¼	..	8 *6-in.*, 4 *3-in.*, 4 M.	3 (sub.)	26	500 1000	390
„	**Kiso** *	5500	500	46¾	15¾	..	Nagasaki (Mitsubishi)	Bldg	..	..	2	..	7 *5·5-in.*, 2 *12-pr.* A A.	8	36·0	..	..
„	**Kitagami**						Sasebo	1920									
„	**Kuma** *						Sasebo	Bldg.									
Scout	**Mogami**	1329	300	31½	9¾	8000 turbines	Sasebo	1907	1908	..	..	..	2 *4·7-in.*, 4 *12-pr.*	2	23·0	95 350	180
l.cr.	**Nagara**	5500	500	46¾	15¾	..	Sasebo	Bldg.	..	..	2	..	7 *5·5-in.*, 2 *12-pr.* A.A.	8	86·0	..	..
„	**Natori**						Nagasaki (Mitsubishi)										
„	**Niitaka**	3420	235½	44	16½	10,000 Nic.	Yokosuka	1902	1905	.	2½	..	6 *6-in.*, 10 *3-in.*, 4 *2½-pr.*	..	20·0	280 600	320
„	**Ohi**	5500	500	46¾	15¾	..	Kobe	1920	..	..	2	..	7 *5·5-in.*. 2 *12-pr.* A.A.	8	36·0	..	..
g.b.	**Saga**	785	..	..	..	1600	Sasebo	1912	1913	..	..	..	1 *4·7-in.*, 3 *3-in.*, 3 M.	..	15	90	..
l.cr.	**Suma**	2657	306¾	40	16½	8500	Yokosuka	1896	1898	237,000	2 shield	4½	2 *6-in.*, 6 *4·7-in.*, 12 *3-pr.*, 4 M.	2	20·0	190 200	300

l. cr.	**Tama** * . .	5500	500	46¾	15¾	..	Nagasaki . . (Mitsubishi)	1920	..	..	2	..	7 *5·5-in.*, 2 *12-pr.* A.A. .	8	36	..	..
,,	**Tatsuta** . .	3500	440	41	13	..	Yokosuka	1918	1919	..	..	..	4 *5·5-in.*, 2 M. . . .	6	31	..	..
,,	**Tenryu** . .						Sasebo .										
,,	**Tone**	4035	400	48½	16¾	15,000 My.	Sasebo . .	1907	1908	..	2–3	..	2 *6-in.*, 10 *4·7-in.*, 2 *12-pr.*, 2 l.	3	23·0	300 900	392
Scout	**Tsugaru** . . . . (*ex* Pallada)	6630	413¼	55¾	21	11,610 My.	Petrograd (Galerny)	1899	1901	..	2½	..	8 *6-in.*, 20 *12-pr.*, 8 *1-pr.* .	4	20·0	900 1400	422
l. cr.	**Tsushima** . . .	3420	235	44	16½	10,000 Nic.	Kure . .	1902	1904	..	2½	..	6 *6-in.*, 10 *3-in.*, 4 *2½-pr.* .	..	20·0	600	320
g.b.	**Uji**	620	180½	7	10	1000 B.	Kure . .	1903	1905	..	..	..	4 *12-pr.*, *3* M. . . .	..	13·0	100	150
l. cr.	**Yahagi**	4950	440	46½	16¾	22,500 P. tur. My.	Nagasaki . .	1911	1912	..	2¼	..	8 *6-in.*. 4 *3-in.*, 4 M. . .	3 (sub.)	26	500 1000	390
,,	**Yodo**	1230	280	32	9¾	6500	Sasebo . .	1908	1909	..	..	..	2 *4·7-in.*, 4 *12-pr.* . .	2	22·0	125 340	180

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* Others of this class, Isuzu, building at Uraga, and Yura, are in early stages of construction. Speed 36 knots estimated.

Submarine depôt ship Karasaki (*ex* Ekaterinoslav), 10,500 tons, 5 light guns.
Repair ship Kwanto Maru. Amakusa, mining vessel (*ex* Amur).
Mercantile auxiliaries: Umegaku Maru, Sakaki Maru, Sakura Maru, 3200 tons, 21 knots; Tsijo Maru, Tenjo Maru, 13,400 tons, 20 knots.
Also the gunboats Toba, 250 tons; Fushimi, 180 tons; Sumida 126 tons; and Saga 785 tons.

NETHERLANDS.

Class.	NAME	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position. Heavy Guns.	Gun Position. Second-ary.	Guns.	Torpedo Tubes.			
		tons	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots	tons.	
a.g.b.	**Brinio** . . .	520	171	28	9¼	1200	Amsterdam .	1912 1913	1915	..	2 K.S.	¾	..	..	..	..	4 *4·1-in.* semi-automatic, 2 M.	..	16	Oil	49
,,	**Friso** . . .																				
,,	**Gruno** . . .																				
c.d.s.	**De Ruyter** . . *Pl.* 36.	5000	316¾	51½	21¾	6377 *t.*	Rotterdam .	1901	1904	347,500	6–4 H.N.S.	2	..	..	10 H.N.S.	3 H.S.	2 *9·4-in.*, 4 *5·9-in.*, 10 *2·9-in.*, 4 *1·4-in.*	3 2 sub.	16·5 *t*	680	347
,,	**Hertog Hendrik** . *Pl.* 36.	5000	316¾	50	21¾	6000 Y.	Amsterdam .	1902	1903	347,500	6 H.N.S.	2	..	..	10 H.N.S.	3 H.S.	2 *9·4-in.*, 4 *5·9-in.*, 10 *2·9-in.*, 4 *1·4-in.*, 2 l.	3	16·5	680	347
,,	**Jacob van Heemskerck**	4921	316¾	50	21¾	6000 Y	Amsterdam .	1906	1908	347,500	6–4 H.N.S.	2	..	..	10 H.N.S.	..	2 *9·4-in.*, 6 *5·9-in.*, 6 *12-pr.*, 4 *1·4-in.*, 2 l.	3 2 sub	16·0	680	351
,,	**Koningin Regentes** *Pl.* 36.	5000	316¾	50	21¾	7290 Y.	Amsterdam .	1900	1902	347,500	6–4 H.N.S.	2	..	..	10 H.N.S.	..	2 *9·4-in.*, 4 *5·9-in.*, 6 *2·9-in.*, 4 *1·4-in.*, 2 l.	3 2 sub.	16·5	680	347
,,	**Marten Tromp** . *Pl.* 36.	5216	316¾	50	21¾	6377 *t*	Amsterdam .	1904	1906	347,500	6–4 H.N.S.	2	..	..	10 H.N.S.	3 H.S.	2 *9·4-in.*, 4 *5·9-in.*, 10 *2·9-in.*, 4 *1·4-in.*	3 2 sub.	16·5 *t*	680	349
,,	**De Zeven Provincien**	6426	339¼	56	20¼	7500 Y.	Amsterdam .	1909	1910	..	6–4 K.S	2	..	..	10 K.S.	..	2 *11-in.*, 4 *5·9-in.*, 10 *12-pr.*	..	16·0	700	409

The light cruisers Java and Sumatra are building respectively at Flushing and Amsterdam, but have not been launched—7050 tons, 65,000 H.P., 30 knots, ten 5·9-in., four 3-in. guns. Light cruisers: Gelderland (1900), 4030 tons, ten 4·7-in., four 3-in., four 1·4 in., 2 M., one torpedo tube, 20 knots; Zeeland (1897), 3900 tons, two 5·9-in., eight 4·7-in., two 2·9-in., four 1·4-in., 2 M., 19·4 knots. Four gun-vessels of small value are in Home waters. There are two modern mine-layers, Medusa and Hydra, two others, Triton and Vulcanus, and six old vessels converted to the same use. Two additional mine-layers, 750 tons, are in hand at Schiedam. In 1920 two old gunboats were in commission in the East Indies, as well as four mine-layers, Assahan, Sardang, Siboga, and Hercules. Surveying vessels in the East Indies, Van Gogh, Van Doorn, Lombok, Sumbawa, Tydeman. Depôt ship for submarines (Pelikaan) building at Amsterdam for the East Indies.

NORWAY.—Armoured Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.			in.	in.			knots.	tons.	
c.d.s.	Eidsvold . Norge . *Pl.* 36.	4233	290	50½	16½	4500 Y.	Elswick	1900	1901	350,000	6 H.N.S.	2	..	..	6 H.N.S.	6 H.N.S.	2 *8·2-in.* 6 *5·9-in.*, 8 *12-pr.*, 6 *3-pr.*	2 sub.	16·9 *t*	400 600	270
,,	Harald Haarfagre .	3920	280	48½	16½	3700	Elswick	1896	1898	300,000	7 H.S.	2	..	..	8 H.S.	..	2 *8-in.*, 6 *4·7-in.*, 6 *12-pr.*, 6 *1½-pr.*	2 sub.	17·2 *t*	200 500	249
,,	Tordenskjold							1897	1899												

Cruising Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
g.b.	Ægger . . .	387	108½	29½	8	450	Horten .	1892	1893	..	1½	..	1 *8·2-in.*, 1 *2·7-in.*, 2 *1·9-in.* . .	..	9·0	..	43
g.b.	Frithjof . .	1349	216½	32¾	13¼	2800	Horten .	1896	1898	..	..	..	2 *4·7-in.*, 6 *12-pr.*, 4 *1·4-in.*, 2 l. . .	3 sub.	15·0	120	166
g.v.	Heimdal . .	620	167¼	26¾	11¾	700	Christiania .	1892	1893	..	..	..	4 *12-pr.*	..	12·0	62	62

Seven Gunboats, of 189 to 280 tons, and of 180 to 450 I.H.P., armed with one large gun and machine guns.

SPAIN.—Armoured Ships.

NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.						Armament.		Speed.	Coal.	Complement.
										Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
														Heavy Guns.	Second-ary.					
	tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
Alfonso XIII. *Pl.* 37.	15,460	435	78¾	25½	15,300 Y. P. tur.	Ferrol	1913	1915	..	9–4 K.S.	2–1	6–5 K.S.	6–3 K.S.	10 K.S.	6 K.	8 *12-in.*, 20 *4-in.*, 2 *3-pr.*, 2 l., 2 M.	3	19·5	800 1900	700
Cataluña	6889	347¾	61	21¾	15,000	Cartagena	1900	1903	600,000	12–10	2	..	12	10½	..	2 *9·4-in.*, 8 *5·5-in.*, 8 *6-pr.*, 2 l.	5 sub.	19·5 *t*	1200	484
Emperador Carlos V. *Pl.* 37.	9089	380	67	25	18,500	Cadiz (Vea Murguia)	1895	1898	734,000	2	6½–2	2	..	10	2	2 *11-in.* (Hontoria), 8 *5·5-in.*, 4 *3·9-in.*, 2 *2·7-in.*, 4 *2·2-in.*, 6 M.	6	20·0	1200	585
España	15,460	435	78¾	25½	15,300 Y. P. tur.	Ferrol	1912	1914	..	9–4 K.S.	2–1	6–5 K.S.	6–3 K.S.	10 K.S.	6 K.	8 *12-in.*, 20 *4-in.*, 2 *3-pr.*, 2 l., 2 M.	3	20·0 *t*	800	700
Jaime I.* *Pl.* 37.							1914	1915										19·5	1900	
Pelayo	9744	330	66	25	9000 Nic.	La Seyne	1887	1890 1897	..	17¾	4	..	..	19¼	4 H.S.	2 *12·5-in.*, 2 *11-in.*, 9 *5·5-in.*, 6 smaller, 12 M.	7	16·0	800	600
Princesa de Asturias	6889	347¾	61	21¾	15,000	Carraca	1896	1902	600,000	12–10	2	..	12	10½	..	2 *9·4-in.*, 10 *5·5-in.*, 8 *6-pr.*, 2 l.	5	18·0	1200	500

* Two others of the class are projected.

SPAIN.—Cruising Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour.		Armament.		Speed.	Coal.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	ins.				knots.	tons.	
g.b.	**Bonifaz**	800	200	30	..	1100 Y	Cartagena	1912	1913	..	..	..	4 *3-in.*, 2 M.	..	13·0	..	..
to.g.b.	**Don Alvaro de Bazán**	810	233	26¾	22	2500	Ferrol	1897	1899	..	..	..	2 *4·7-in.* (Hontoria), 4 *1·6-in.*, 2 M.	4	19·0	..	110
”	**Doña María de Molina**	810	233	26¾	22	2500	Ferrol	1896	1898								
cr.	**Extremadura**	2030	290	36	14	7000 T	Cadiz	1900	1902	..	2	..	8 *4-in.* (Vickers), 4 *2·2-in.*, 2 *1·4-in.*, 1 l.	..	20·0	430	246
g.b.	**Lauria**	800	200	30	..	1100 Y	Cartagena	1912	1913	..	..	..	4 *3-in.*, 2 M.	..	13·0	..	..
”	**Laya**																
to.g.b.	**Marqués de la Victoria**	810	233	26¾	22	2500	Ferrol	1897	1900	..	..	..	2 *4·7-in.* (Hontoria), 4 *1·6-in.*, 2 M.	4	19·0	..	110
g.b.	**Recalde**	800	200	30	..	1100 Y	Cartagena	1911	1912	..	..	..	4 *3-in.*, 2 M.	..	13·0	..	..
cr.	**Reina Regente**	5287	337	529	19¾	6500 W.T.	Ferrol	1906	1908	..	..	3	10 *5·5-in.*, 12 *2·2-in.*, 2 l., 8 M.	3	20·0	1200	497
”	**Reina Victoria Eugenia**	5590	364	52½	16½	11,000 T.	Ferrol	1920	..	..	2 (1½ side)	..	9 *6-in.*, 4 *3-pr.*, 1 l., 4 M.	2 (sub.)	25·0	..	..
”	**Rio de la Plata** . shd.	1773	246	35¼	15	7100 N.S.	Havre	1898	1899	..	..	1	2 *5·5-in.*, 4 *3·9-in.*, 4 *2·2-in.*, 6 M.	2	20·0	270	213

Hernán Cortés, Vasco Nuñez de Balboa, Marqués de Molins, Ponce de Léon, MacMahon, Perla, Nueva España and Temerario, gun-vessels.
The new programme included two additional light cruisers of the 5590-ton class, six destroyers, 28 submarines, three gunboats and other vessels, as well as provision of mines, &c., and necessary plant and supplies for the Ferrol and Cartagena dockyards.

SWEDEN.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost.	Armour. Belt.	Armour. Deck.	Armour. Side above Belt.	Armour. Bulkhead.	Armour. Gun Position. Heavy Guns.	Armour. Gun Position. Second-ary.	Armament. Guns.	Armament. Torpedo Tubes.	Speed.	Coal.	Complement.
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
c.d.s., t.	**Aeran** . .	3650	287	49¼	16½	6500 Y.	Gothenburg	1901	1902	..	7 K.S.	1⅞	..	..	7½ K.S.	5 K.S.	2 8·*2-in.*, 6 *5·9-in.*, 10 *2·2-in.*, 1 *1·4-in.*, 2 M.	2 sub.	17·2 *t*	370	250
„	**Dristigheten** .	3620	285	48½	16	5400 Y.	Gothenburg	1900	1901	..	8 K.S.	1⅞	..	..	8 N.S.	3¾ K.S.	2 8·*2-in.*, 6 *5·9-in.*, 10 *2·2-in.*, 1 *1·4-in.*, 2 M.	2 sub.	16·5	800	250
a.c.	**Drottning-Victoria** *Pl.* 38.	7605	390½	61	21½	22,000 tur. Y.	Gothenburg	1917	1920	666,000	8–6 K.S.	12	4 H.S.	..	8 K.S.	5 K.S.	4 *11-in.*, 8 *6-in.*, 6 *12-pr.*, 2 *2·2-in.*, *1-pr.*, 2 M.	2 sub.	22·0	350 800	450
„	**Fylgia** . .	4980	377¼	48¾	16	12,440 Y. *t*	Stockholm .	1905	1907	385,700	4 K.S.	2	..	..	5 K.S.	5 K.S.	8 *5·9-in.*, 14 *2·2-in.*, 2 *1·4-in.* .	2	22·5 *t*	350 900	321
„	**Gustav V.** *Pl.* 38.	7605	390½	61	21½	22,000 tur. Y.	Malmö . .	1917	1920	666,000	8–6 K.S.	12	4 H.S.	..	8 K.S.	5 K.S.	4 *11-in.*, 8 *6-in.*, 6 *12-pr.*, 2 *2·2-in.*, 2 M.	2 sub.	22·0	350 800	450
c.d.s., t.	**Manligheten** .	3870	287	49¼	16½	7400 Y.	Malmö .	1904	1906	..	7 K.S.	1⅞	..	..	7½ K.S.	5 K.S.	2 8·*2-in.*, 6 *5·9-in.*, 8 *2·2-in.*, 1 *1·4-in.*	2 sub.	17·0	370	250
„	**Oscar II** . . *Pl.* 38.	4658	313¾	49½	16¾	8500 Y.	Gothenburg	1905	1907	..	6 K.S.	2	6 K.S.	6 K.S.	7½ K.S.	5 K.S.	2 8·*2-in.*, 8 *5·9-in.*, 10 *2·2-in.*, 1 *1·4-in.*	2 sub.	18·0	350 500	326
a.c.	**Sverige** . . *Pl.* 38.	7665	390½	61	21½	20,000 tur. Y.	Stockholm .	1914	1918	666,000	8–6 K.S.	1½	4 K.S.	..	8 K.S.	5 K.S.	4 *11-in.*, 8 *6-in.*, 6 *12-pr.*, 2 *2·2-in.*, 2 M.	2 sub.	22·0	350 800	450
c.d.s., t.	**Tapperheten** .	3990	287¼	49¼	16½	6000 Y.	Malmö .	1901	1904	..	7 K.S.	1⅞	..	..	7½ K.S.	5 K.S.	2 8·*2-in.*, 6 *5·9-in.*, 8 *2·2-in.*, 1 *1·4-in.*, 2 M.	2 sub.	16·5	370	250
„	**Wasa** . .	3745	287	49¼	16½	6000 Y.	Stockholm .	1901	1893	..	7 K.S.	1⅞	..	..	7½ K.S.	5 K.S.	2 8·*2-in.*, 6 *5·9-in.*, 10 *2·2-in.*, 1 *1·4-in.*	2 sub.	16·5	370	250

Older coast-defence ships Göta and Thule (1891-1894), 3393 tons, 1 8·2-in., 7 5·9-in. guns; Oden, Thor, Njord (1890, 1898, 1899), 3715 tons, 2 9·8-in., 6 4·7-in. guns. Torpedo gunboats Claes Horn, Jacob Bagge, Oernen, Psilander, 880 tons, 2 4·7-in., 4 2·2-in., 20 knots. Four gunboats, 200 tons, each 1·5-in. guns.

UNITED STATES.—Armoured Ships.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost. *	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	**Alabama.**	11,552	368	72¼	24¾	11,207 *t*	Philadelphia	1898	1900	544,539	16½–4 H.S.	2¾–4	5¼ H.S.	12 H.S.	15 H.S.	6 H.S.	4 *13-in.*, 8 *6-in.*, 2 *3-in.* A.A., 16 *6-pr.*, 10 *1-pr.*, 4 M., 2 l.	..	21·9 *t*	800 1275	592
b.	**Arizona** . *Pl.* 39.	31,400	600	97	28¾ †	34,000 Y.	New York .	1915	1916	1,485,000	14 K.S.	3	..	..	18 K S.	..	12 *14-in.* (45 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*	4 (sub.)	21 0	2914 Oil	1002
b.	**Arkansas** *Pl.* 43.	26,000	554	93¼	28½ †	28,533 P. tur.	Camden, N.J.	1911	1912	964,000	11–5 K.S.	3	..	8–6 K.S.	11 K.S	6½	12 *12-in.*, 16 *5-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 4 M., 1 l.	2 (sub.)	21·0 *t*	1650 2500	1115
a. c.	**Brooklyn.**	9215	400½	62	26½	18,425 *t*	Philadelphia	1895	1896	613,583	3 H.S.	6–3	4 H.S.	..	8 H.S.	5½ H.S.	8 *8-in.*, 8 *5-in.*, 2 *3-in.* A.A., 14 *6-pr.*, 10 *1-pr.*, 2 M., 1 l.	..	22·2 *t*	900 1622	718
b.	**California**	32,300	624	97½	30¼	28,500	Mare Island (Navy Yard)	Bldg.	..	..	14 K.S.	..	..	..	18 K.S.	9 K.S.	12 *14-in.* (50 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 M.	2 (sub.)	21·0	2914 Oil	1067
a. c.	**Charleston**	9700	424	66	35 †	27,500 B.&W.	Newport News	1904	1906	563,030	4 H.S	3	4 H.S.	..	4 H.S.	..	12 *6-in.*, 4 *3-in.*, 2 *3-in.* A.A., 10 M., 2 l.	..	22·0	650 1500	664
a.c.	**Charlotte** (*ex* North Carolina)	14,500	502	72¾	25 ‡	29,785 B. & W.	Newport News	1906	1908	970,630‡	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 4 *6-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 15 M. & l.	4 sub.	21·9 *t*	900 2000	845
b.	**Colorado.**	32,600	600	97½	30½ †	28,900 T.	N.Y.S.B. Co.	Bldg.	..	1,383,000	16–14 K.S.	..	..	..	18 K.S.	9 K.S.	8 *16-in.* (45 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*	2 (sub.)	21·0	..	..
b.	**Connecticut**	16,000	450	76¾	26¾	20,525 B. & W.	Camden, N.J.	1904	1906	819,300	11½ K.S.	3	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., l., M., and A.A.	4 (sub.)	18·8 *t*	900 2200	803
b.c.	**Constellation** **Constitution** *Pl.* 41.	43,500	850	105½	31 †	180,000 T. electric	Newport News Philadelphia	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	8 (4 sub.)	33·3	Oil	1315
b.	**Delaware** *Pl.* 44.	20,000	510	85¼	27 †	28,578	Newport News	1909	1910	817,300	11 K.S.	..	10–8 K.S.	..	11 K.S.	5 K.S.	10 *12-in.*, 4 *5-in.*, 2 *3-in.* A.A. 12 l.	2 (sub.)	21·5 *t*	1000 2500	927
b.	**Florida** . *Pl.* 44.	21,825	510	88¼	28½ †	27,036 tur.	New York .	1910	1911	1,280,000	11	..	10	..	11	5	10 *12-in.*, 6 *5-in.*, 4 *3-in.* A.A. L. and M.	2 (sub.)	22·1 *t*	1000 2300	1014
a.c.	**Frederick** (*ex* Maryland)	13,680	502	69½	24½	28,059 B. & W.	Newport News.	1903	1905	756,400	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 4 *6-in.*, 10 *3-in.*, 2 *3-in.* A.A., 14 l.	2 (sub.)	22·4 *t*	900 1850	829

*** The sums given in this column are exclusive of the cost of armour and armament according to the system of making appropriations in the estimates. Congress fixed the limit of cost of the six battleships of the North Carolina class at 21,000,000 dollars each, but the Iowa and Massachusetts are being built on the basis of actual cost plus a fixed profit of 1,650,000 dollars. The six battle cruisers are being built on a cost plus 10 per cent. basis, with limit of cost of 23,000,000 dollars.**

† Mean draught.

‡ Including armour, but not armament.

UNITED STATES.—Armoured Ships—*continued.*

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost. *	Armour.						Armament.		Speed.	Coal.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.						in.	in.	in.	in.	in.	in.			knots	tons	
Super-posed turrets.	**Georgia** . .	14,948	435	76¼	23¾ †	25,088*t* Nic.	Bath, Me. .	1904	1906	737,700	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *3-in.*, 2 *3-in* A.A., 4 *3-pr.*, 17 l.	4 (sub.)	19·2 *t*	900 1704	812
a c.	**Huntington** . (*ex* West Virginia)	13,680	502	69½	24½	31,437 B. & W.	Newport News	1903	1905	798,310	6–3½ K.S.	4	5 K.S.	12 H.S.	6 K.S.	5 K.S.	4 *8-in.*, 4 *6-in.*, 10 *3-in.*, 2 *3-in.* A.A., 8 *1-pr.*, 4 M., 1 l.	2 (sub.)	22·1 *t*	900 2000	829
a.c.	**Huron** . . (*ex* South Dakota)	13,680	502	69½	26	28,598 B. & W.	S. Francisco.	1904	1907	770,570	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 4 *6-in.*, 10 *3-in.*, 2 *3-in.* A.A., 7 *1-pr.*, 1 l.	2 sub.	22·0 *t*	900 2000	829
b.	**Idaho** . . *Pl.* 39.	32,000	624	97¾	30 †	32,000 Y.	Camden, N.J.	1917	1919	1,485,000	14 K.S.	3	..	..	18 K.S.	..	12 *14-in.* (50 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*, 4 M.	2 (sub.)	21·0	2914 Oil	1007
b.	**Indiana** . . *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	New York Navy Yard	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	2 (sub.)	23·0	Oil	1470
b.	**Illinois** . .	11,552	368	72¼	24¾	12,757	Newport News	1898	1901	533,237	16½–4 H.S.	2¾–4	5¼ H.S.	12 H.S.	15 H.S.	6 H.S.	4 *13-in.*, 8 *6-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 6 *1-pr.*, 17 M., 2 l.	..	17·45 *t*	800 1275	686
b.	**Iowa** . . *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	Newport News	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	2 (sub.)	23·0	Oil	1470
b.	**Kansas** . .	16,000	450	77	26¾	19,545 B. & W.	Camden, N.J.	1905	1907	855,850	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 14 M. and l.	4 (sub.)	18·1 *t*	900 2200	854
Super-posed turrets.	**Kearsarge** **Kentucky**	11,520	368	72¼	25	11,788 12,179	Newport News	1898	1899	462,345 each	16½–4 H.S.	2¾–5	5½ H.S.	..	15 H.S.	9 H.S.	4 *13-in.*, 4 *8-in.*, 8 *5-in.*, 2 *3-in.* A.A., 8 M. and l.	.. ..	16·8 16·9 *t*	410 1591	690 686
b.c.	**Lexington** . *Pl.* 41.	43,500	850	105½	31 †	180,000 T. electric	Quincy, Mass.	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A. M. and l.	8 (4 sub.)	33·3	Oil	1315
b.	**Louisiana** .	16,000	450	76¾	26¾	20,748 B. & W.	Newport News.	1904	1906	819,300	11–8 K.S.	3	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 24 M. and l.	4 (sub.)	18·8 *t*	900 2200	803

b.	**Maine** .	12,500	388	72¼	25½	15,698 Nic.	Philadelphia	1901	1902	592,828	11–4 K.S.	2¾–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 8 *6-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 8 *1-pr.*, 4 M., 1 l.	2 (sub.)	18·0 *t*	1000 1800	551
b.	**Maryland** .	32,600	600	97½	30½ †	28,900 T.	Newport News	1920	..	1,383,000	16–14 K.S.	..	..	..	18 K.S.	9 K.S.	8 *16-in.* (45 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*	2 (sub.)	21·0	..	..
b.	**Massachusetts** *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	Quincy,Mass. Bethlehem	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	2 (sub.)	23·0	Oil	1470
b.	**Michigan** .	16,000	450	80½	24½ †	16,310 B. & W.	Camden, N.J.	1908	1909	700,000	11–9	3	8	10	10–8	8	8 *12-in.*, 12 *3-in.*, 2 *3-in.* A.A., 2 *3-pr.*, 2 M., 1 l.	2 (sub.)	18·8 *t*	900 2200	669
b.	**Minnesota** .	16,000	450	77	26¾	20,235 B. & W.	Newport News	1905	1907	844,500	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 14 *1-pr.*, 4 M.	4 (sub.)	18·8 *t*	900 2200	881
b.	**Mississippi** *Pl.* 39.	32,000	624	97¾	30 †	32,000 Y.	Newport News	1917	1917	1,485,000	14 K.S.	3	..	..	18 K.S.	..	12 *14-in.* (50 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.* 14 l.	2 sub.	21·0	2914 Oil	..
a.c.	**Missoula** (*ex* Montana)	14,500	502	72¾	27 †	27,938 B. & W.	Newport News	1906	1908	970,630‡	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 4 *6-in.*, 2 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 10 *1-pr.*, 4 M., 1 l.	4 sub.	22·2 *t*	900 2000	845
b.	**Missouri** .	12,500	388	72¼	25½	15,845 T.	Newport News	1901	1903	592,828	12–4 K.S.	2¾–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 8 *6-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 14 *1-pr.*, 2 M., 1 l.	2 sub.	18·1 *t*	1000 1836	551
b.	**Montana** *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	Mare Island Cal. Navy Yard	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A A.	2 (sub.)	23·0	Oil	1470
Super-posed turrets.	**Nebraska** .	14,948	435	76¼	23¾ †	21,283 B. & W.	Seattle. .	1904	1907	767,210	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *3-in.*, 2 *3-in.* A.A.; 4 *3-pr.*, 20 *1-pr.*, 4 M., 1 l.	4 sub.	19·1 *t*	900 1900	812
b.	**Nevada** *Pl.* 40.	27,500	575	95	28½ †	23,312 Cur. tur.	Quincy, Mass.	1914	1915	1,211,342	13½–8 K.S	1½–3	13½–8 K.S.	13½ K.S.	18–16 K.S.	5 K.S.	10 *14-in.* (45 cal.), 12 *5-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 18 l. & M.	2 sub.	20·5	1300 2000	..
b.	**NewHampshire**	16,000	450	77	26¾	19,100 B. & W.	Camden, N.J.	1906	1908	1,600,000 (Total)	9–4 K.S.	3	7 K.S.	7 K.S.	12 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 14 *1-pr.*, 4 M.	4 sub.	18·2 *t*	900 2350	916
Super-posed turrets.	**New Jersey** .	14,948	435	76¼	23¾ †	23,089 B. & W.	Quincy,Mass.	1904	1906	699,680	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 8 *1-pr.*, 4 M., 1 l.	4 sub.	19·4 *t*	900 1900	812
b.	**New Mexico** . *Pl.* 39.	32,000	624	97¾	30 †	27,500 Y. Electric drive	New York .	1917	1918	1,485,000	14 K.S.	3	..	..	18 K.S.	..	12 *14-in.* (50 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.* 6 l. & M.	2 (sub.)	21·4	2914 Oil	..
„	**New York** . *Pl.* 42.	27,000	565	95¼	28½ †	29,687	New York .	1912	1914	1,315,114	12–4 K S	3	9 K.S.	10 K.S.	14–8 K.S.	6 K.S.	10 *14-in.* (45 cal.), 16 *5-in.*, 2 *3-in.* A.A., 4 *3-pr.* 13 l. & M.	4 sub.	21·5	2200 2850	1074

* See note on page 261.

† Mean draught.

‡ Including armour, but not armament.

UNITED STATES.—Armoured Ships—*continued.*

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost. *	Armour.						Armament.		Speed.	Normal Coal Supply.	Complement.
											Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
															Heavy Guns.	Second-ary.					
		tons.	ft.	ft.	ft.					£	in.	in.	in.	in.	in.	in.			knots.	tons.	
b.	**North Carolina** *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	Norfolk, Va. Navy Yard	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	2 (sub.)	23·0	Oil	1470
b.	**North Dakota.** *Pl.* 44.	20,000	510	85¼	28¾ †	31,000 Cur. tur.	Quincy, Mass.	1908	1910	899,500	11 K.S.	..	10–8 K.S.	..	11 K.S.	5 K.S.	10 *12-in.*, 4 *5-in.*, 2 *3-in.* A.A., 2 *3-pr.*, 14 l., 4 M.	2 sub.	21·0 *t*	1000 2500	960
b.	**Ohio** . .	12,500	388	72¼	25½	16,220 T.	S. Francisco.	1901	1904	595,705	11·4 K.S.	3–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 8 *6-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 16 *1-pr.*, 2 M., 1 l.	2 sub.	17·8 *t*	1000 2144	521
b.	**Oklahoma** . *Pl.* 40.	27,500	575	95	29¾ †	21,703	New York .	1914	1915	2,200,000	13½–8 K.S.	1½–3	13½–8 K.S.	13½ K.S.	18–16 K.S.	5 K.S.	10 *14-in.* (45 cal.), 12 *5-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 19 l. & M.	2 sub.	20·5	1300 2000	..
b.	**Pennsylvania.** *Pl.* 39.	31,400	600	97	29¾ †	31,500 *t* Y.	Newport News	1915	1916	1,485,000	14 K.S.	3	..	..	18 K.S.	..	12 *14-in.* (45 cal.), 12 *5-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 14 l., 4 M.	2 sub.	21·0	2914 Oil	1002
a.c.	**Pittsburg** .	13,680	502	69½	26	28,600 Nic.	Philadelphia (Cramp)	1903	1905	799,340	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 4 *6-in.*, 10 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 18 *1-pr.*, 8 M., 1 l.	2 sub.	22·4 *t*	900 2000	829
a. c.	**Pueblo** . . (*ex* Colorado)	13,680	502	69½	24½	26,837 Nic.	Philadelphia	1903	1905	756,000	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 4 *6-in.*, 10 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 12 *1-pr.*, 4 M., 1 l.	2 (sub.)	22·2 *t*	900 2000	829
b.c.	**Ranger** . . *Pl.* 41.	43,500	850	105½	31 †	180,000 T. electric	Newport News	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A., M. & l.	8 (4 sub.)	33·3	Oil	1315
Super-posed	**Rhode Island** .	14,948	435	76¼	26 †	20,310 B. & W.	Quincy, Mass.	1904	1906	699,680	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 8 *1-pr.*	4 sub.	19·0 *t*	900 1900	812
a.c.	**Rochester** . (*ex* Saratoga)	8200	380½	64¾	26¼ †	17,075	Philadelphia (Cramp)	1891	1893 1909	613,377	4 H.S.	2½	.. K.S.	..	6½ H.S.	5–4 H.S.	4 *8-in.*, 8 *5-in.*, 2 *3-in.* A.A., 19 l. & M.	..	21·0 *t*	750 1334	498

a.c.	**St. Louis** .	9700	424	66	22½ †	27,264 B. & W.	Philadelphia (Cramp)	1905	1906	563,030	4 K.S.	3	4–3	..	4 K.S.	..	12 *6-in.*, 4 *3-in.*, 2 *3-in.* A.A., 2 *3-pr.*, 12 l. & M.	..	22·1 *t*	650 / 1500	664
b.c.	**Saratoga** . *Pl.* 41.	43,500	850	105½	31 †	180,000	N.Y. Shipbuilding Co.	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A., M. & l.	8 (4 sub.)	33·3	Oil	1315
a.c.	**Seattle** . (*ex* Washington)	14,500	502	72¾	27	27,152 B. & W.	Camden, N. J.	1905	1906	970,630‡	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 4 *6-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *6-pr.*, 4 M., 11 l.	4 sub.	22·3 *t*	900 / 2000	858
b.	**South Carolina**	16,000	450	80¼	27 †	18,357 B. & W.	Philadelphia (Cramp)	1908	1909	730,000	11–9	3	8	10	10–8	8	8 *12-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 M., 11 l.	2 sub.	18·9 *t*	900 / 2200	669
b.	**South Dakota** . *Pl.* 41.	43,200	660	106	33 †	60,000 T. electric	New York Navy Yard	Bldg.	..	..	..	..	..	..	..	..	12 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A.	2 (sub.)	23·0	Oil	1470
b.	**Tennessee** .	32,300	600	97¼	30¼ †	28,500 T.	New York Navy yard	1919	1920	..	14 K.S.	..	..	..	18 K.S.	9 K.S.	12 *14-in.* (50 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*, 6 l.	2 sub.	21·0	2941 Oil	1007
b.	**Texas** . *Pl.* 42.	27,000	565	95¼	28½ †	28,100 *t*	Newport News	1912	1914	1,166,000	12–4 K.S.	3	9 K.S.	10 K.S.	14–8 K.S.	6 K.S.	10 *14-in.* (45 cal.), 6 *5-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 13 l.	4 sub.	21·1 *t*	2200 / 2850	1074
b. c.	**United States** *Pl.* 41.	43,500	850	105½	31 †	180,000 T. elec.	Philadelphia Navy yard	Bldg.	..	..	..	..	..	..	..	..	8 *16-in.* (50 cal.), 16 *6-in.*, 4 *3-in.* A.A., M. & l.	8 (4 sub.)	33·3	Oil	1315
b.	**Utah** . *Pl.* 44.	21,825	510	88¼	28½	28,477 *t.*, P. tur.	Camden, N.J.	1909	1911	813,500	11	..	10	..	11	5	10 *12-in.*, 6 *5-in.*, 4 *3-in.* A.A., 4 *3-pr.*, 4 M., 1 l.	2 sub.	21·6 *t*	1000 / 2300	1014
b.	**Vermont** .	16,000	450	77	26¾	17,982 B. & W.	Quincy, Mass.	1905	1907	858,730	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *3-in.*, 2 *3-in.* A.A., 4 *3-pr.*, 8 *1-pr.*, 2 M., 1 l.	4 sub.	18·33 *t*	900 / 2200	854
Superposed	**Virginia** .	14,948	435	76¼	23¾ †	22,841 Nic.	Newport News	1904	1906	737,700	11–8 K.S.	3	6 K.S.	6 K.S.	11 K S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *3-in.*, 2 *3-in.* A.A., 8 *1-pr.*, 2 M., 1 l.	4 sub.	19·0 *t*	900 / 1900	812
b. *b.*	**Washington** **West Virginia**	32,600	600	97¼	30½ †	28,900 T.	N.Y.S.B. Co. Newport News	Bldg.	..	1,383,000	16–14 K.S.	..	..	..	18 K.S.	9 K.S.	8 *16-in.* (45 cal.), 14 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*	2 sub.	21·0	..	..
b.	**Wisconsin** .	11,552	368	72¼	26	12,452	S. Francisco.	1898	1901	549,666	16½–4 H.S.	3–4	5¼ H.S.	..	15 H.S.	6 H.S.	4 *13-in.*, 8 *6-in.*, 2 *3-in.* A.A., 16 *1-pr.*, 4 M., 1 l.	..	17·2 *t*	800 / 1310	583
b.	**Wyoming** . *Pl.* 43.	26,000	554	93¼	29¾ †	31,437 P. tur.	Philadelphia	1911	1912	963,800	11–9 K.S.	..	..	8–6 K.S.	11 K.S.	8	12 *12-in.*, 6 *5-in.*, 4 *3-in.* A.A., 4 *6-pr.*, 4 M., 13 l.	2 sub.	21·2 *t*	1650 / 2500	1115

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* See note on p. 261.

† Mean Draught.

‡ Including armour, but not armament.

Coast battleships Nos. 1 and 2 (*ex* Indiana and Massachusetts), also Oregon, 10,288 tons; No. 4 (*ex* Iowa), 11,346 tons: four 13-in., eight 8-in., four 3-in. guns; completed 1895–97. Monitors Monadnock, 3990 tons, Tonopah (*ex* Nevada), 3714 tons, Tallahassee (*ex* Florida) and Ozark (*ex* Arkansas), 3235 tons, Cheyenne (*ex* Wyoming) 3218 tons, Monterey, 4084 tons.

UNITED STATES.—Cruising Ships, &c.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Cost. *	Armour.		Armament.		Speed.	Normal Coal Supply.	Complement.
											Deck.	Gun Position.	Guns.	Torpedo Tubes.			
		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
l. cr.	Albany . shd.	3487	346	43¾	29	7500	Elswick .	1899	1900	247,611	3	3–1¼ shields	8 *5-in.*, 1 *3-in.* A.A., 2 *3-pr.*, 2 *1-pr.*, 4 M., 1 l.	..	20·5 *t*	512 747	356
g.v.	Asheville . .	1575	225	41¼	11¼†	800	Charleston .	1918	..	176,718	..	..	3 *4-in.*	..	12	..	..
scout	Birmingham .	3750	420	47	18¾†	15,670 Express	Quincy, Mass.	1907	1908	301,000	2–1½	..	4 *5-in.*, 2 *3-in.*, 1 *3-in.* A.A., 4 M.	2 sub.	24·3 *t*	1250 1433	356
l. cr.	Chattanooga . shd.	3200	292	44	17	5303 B.&W.	Elizabeth Port	1903	1904	212,325	2	..	6 *5-in.*, 1 *3-in.* A.A., 4 *6-pr.*, 2 *1-pr.*, 2 M., 1 l.	..	16·65 *t*	470 700	302
scout	Chester . .	3750	420	47	18¾†	16,000 Nor. turb.	Bath, Me. .	1907	1908	337,000	2–1½	..	4 *5-in.*, 2 *3-in.*, 1 *3-in.* A.A., 4 M.	2 sub.	26·5 *t*	12 0 1433	356
l. cr.	Cincinnati . .	3213	300	42	19½	8,490 B.&W.	Brooklyn .	1892	1894	226,055	2½	4	4 *5-in.*, 1 *3-in.* A.A., 7 *6-pr.*, 2 *1-pr.*, 2 M.	..	19·0	350 727	314
[illegible]	Cleveland . shd.	3200	292	44	17	4640 B.&W.	Bath, Me. .	1901	1903	212,325	2	..	6 *5-in.*, 1 *3-in.* A.A., 2 *1-pr.*, 2 M., 1 l.	..	16·4 *t*	470 700	302
,, .	Columbia . .	7350	412	58¼	24½	18,509	Philadelphia	1892	1894	559,950	4–2½	4 shield	3 *6-in.*, 4 *4-in.*, 2 *3-in.* A.A., 4 *1-pr.*, 2 *3-pr.*	..	22·8 *t*	750 1670	477
,, . ,, .	Denver . Des Moines } shd. {	3200 }	292	44	17	4135 B. & W.	{ Philadelphia Quincy, Mass. }	1902	1904	212,325	2	..	6 *5-in.*, 1 *3-in.* A.A., 4 *6-pr.*, 2 *1-pr.*, 4 M., 1 l.	..	16·65	470 700	303
g.v.	Dubuque . .	1085	174	35	13	1193 B. & W.	Morris Heights, N.Y.	1904	1905	60,619	..	..	2 *4-in.*, 4 *6-pr.*, 2 *1-pr.*, 3 M.	..	12·9	200	162
l. cr.	Galveston . shd.	3200	292	44	17	5073 B. & W.	Richmond, Va.	1903	1904	212,325	2	..	6 *5-in.*, 1 *3-in.* A.A., 4 *6-pr.*, 2 *1-pr.*, 4 M., 1 l.	..	16·4	470 700	302

		tons.	ft.	ft.	ft.					£	in.	in.			knots.	tons.	
l. cr.	**Minneapolis**	7350	412	58¼	24½	20,862	**Philadelphia**	1893	1894	552,754	4–2½	4 shield	3 *6-in.*, 4 *4-in.*, 2 *3-in.* A.A., 2 *1-pr.*, 2 M.	..	23·0 *t*	750 1433	477
”	**New Orleans** shd.	3487	346	43¾	19	7500	**Elswick**	1896	1898	293,684	..	3–1¼ shields	8 *5-in.*, 1 *3-in.* A.A., 2 *3-pr.*, 2 *1-pr.*, 4 M.	..	20·0	512 767	366
g.v.	**Paducah**	1085	174	35	18¼	1000 B.&W.	Morris Heights, N.Y.	1904	1905	72,948	..	..	4 *4-in.*, 4 *6-pr.*, 2 *1-pr.*, 4 M.	..	12·85	200	162
g.v.	**Sacramento**	1425	225	40¾	11½	1022	Philadelphia	1913	1914	101,200	..	..	3 *4-in.*, 2 *3-pr.*, 2 M., 2 l.	..	12·8 *t*	428	156
scout	**Salem**	3750	420	47	18¾	22,242 W.T. turb.	Quincy, Mass.	1907	1908	301,000	2–1½	..	4 *5-in.*, 2 *3-in.*, 1 *3-in.* A.A., 2 M.	2 sub.	25·9 *t*	1250 1433	356
l. cr.	**Tacoma** shd.	3200	292	44	17	5288 B.&W.	S. Francisco.	1903	1904	212,325	..	2 shields	6 *5-in.*, 1 *3-in.* A.A., 4 *6-pr.*, 2 *1-pr.*, 4 M.	..	16·6 *t*	470 700	302
sc. cr.	**Nos. 4, 5, 6** *Pl.* 44.	7100	550	55	14¼	90,000	Tacoma, Wash.	Bldg.	..	..	..	..	8 *6-in.*, 2 *14-pr.* A.A., 2 *3-pr.*	2 twin	35	Oil	..
”	**Nos. 7, 8** *Pl.* 44.	7100	550	55	14¼	90,000	Quincy, Mass. (Bethlehem)	Pro.	..	..	..	..	8 *6-in.*, 2 *14-pr.* A.A., 2 *3-pr.*	2 twin	35	Oil	..
”	**Nos. 9, 10** *Pl.* 44.	7100	550	55	14¼	90,000	Philadelphia (Cramp)	Bldg.	..	..	..	..	8 *6-in.*, 2 *14-pr.* A.A., 2 *3-pr.*	2 twin	35	Oil	..
”	**Nos. 11, 12, 13** *Pl.* 44.	7100	550	55	14¼	90,000	Philadelphia (Cramp)	Pro.	..	..	..	..	8 *6-in.*, 2 *14-pr.* A.A., 2 *3-pr.*	2 twin	35	Oil	..

* **Prices exclusive of armament.**

Gun vessels Helena, Machias, Marietta, Nashville, Newport, Vicksburg, Wheeling, and Wilmington, 1000 to 1392 tons, launched 1895–97; seventeen others. Aircraft carriers Charles and Yale. Thirty-five tank and other fuel ships. Mine-layers Aroostook, Baltimore, San Francisco, and Shawmut, carrying 5-in., and small anti-aircraft guns. A large flotilla of mine-sweepers and tugs. Submarine tenders Beaver, Bushnell, Camden, Fulton, Holland, Rainbow, and Savannah. Destroyer depôt ships Black Hawk, Bridgeport, Buffalo, Dixie, Dobbin, Leonidas, Melville, Panther, Prairie, and Whitney. Repair ships Medusa, 10,000 tons, Prometheus and Vestal, 12,595 tons. Radio repair ship Saturn. Hospital ships Boston, Comfort, Mercy, Relief, and Solace Ulysses and Achilles, colliers, for the Panama Canal. River gunboats Monocacy and Palos, completed 1914.

Training ships Olympia, 5870 tons; Chicago, 4500 tons; Anniston (*ex* Marblehead), 2089 tons. Torpedo experimental vessel Montgomery, 2089 tons.

The ocean liners St. Louis and St. Paul, 11,629 tons, New York and Philadelphia, 10,802 tons, 20 knots (International Navigation Co.), and the Korea and Siberia, 11,200 tons, 18 knots (Pacific Mail Steamship Co.) are enrolled auxiliary cruisers.

SHIPS OF THE LESSER NAVIES.

Belgium.—The maritime affairs of Belgium are at present administered in association with the internal railway organisation, but a Naval Commission has been formed, and it is intended to purchase some sloops and other small vessels. The nucleus of a Navy exists in the small destroyers left by the Germans in Belgian harbours.

Bulgaria.—Under the terms of the naval clauses of the Peace Treaty, Bulgarian warships of all classes, existing or under construction, were to be surrendered to the Allied and Associated Powers or be broken up, as well as all naval arms, munitions, and war material. No submarines may be built or acquired even for commercial purposes.

China.—The principal vessels of the Chinese Navy have been built in England. The Cha-Ho and Ying-Swei are cruisers of 2600 tons, completed respectively at Elswick and Barrow in 1912. With turbine engines of 6500 H.P., they had a speed of 22 knots. There is ¾-in. deck protection; armament, two 6-in., four 4-in., two 12-pr. and some smaller guns, with two torpedo tubes. The Hai-Chi (Elswick, 1899) displaces 4300 tons, and with 17,000 H.P. is given a speed of 24 knots; armament, two 8-in., ten 4·7-in., twelve 12-pr., and ten smaller guns; five torpedo tubes. The cruisers Hai-Shen, Hai-Chew, and Hai-Yung, 2954 tons, were completed by the Vulkan Company at Stettin in 1898. They attained 20·7 knots on trial (7500 H.P.); armament, three 6-in., eight 4-in., twelve machine guns, three torpedo tubes, of which one submerged. For the Yangtsze are the gun-vessels Kien-Wei and Kien-An, 871 tons, one 3·9-in. and smaller guns, built at Foochow in 1892; the Yung-Fang, Yung-Kien, Yung-Chon, Yung-Tsih, similar vessels built in Japan and at Kiang-Nan; six others built at Kobe (two 4·7-in.), four smaller (550 tons, one 4·7-in.), two smaller (150 tons), and seven light draught gunboats. Three small destroyers (400 tons, 35 knots, two 12-pr., four 3-pr., 2 tubes). Tung-An, Yu-Chang, Kien-Kon, were built at Elbing in 1912; torpedo-boats, Chen-Suh (120 tons, two 3-pr., three tubes, 20 knots (Stettin, 1907), and twenty-one smaller boats.

Colombia.—Cruiser Almirante Lezo (*ex* El Baschir), 1200 tons; 2500 H.P.; 18 knots; built 1892, bought from Morocco. Gunboats, Chercinto and Bogota. River gunboats, General Nerino and Esperanza, 400 tons. Three Yarrow motor gunboats, 1913.

Cuba.—Cruiser Cuba, 2055 tons, 3500 H.P. 18 knots, and four gunboats.

Ecuador.—The torpedo cruiser Almirante Simpson, 812 tons, bought from Chili. One torpedo-boat and two transport vessels.

Egypt.—The Nile stern-wheel gunboats Sultan, Sheikh, and Melik, 140 tons, Fateh and Naseh, 128 tons; also the Abu Klea, Hafir, Metemmeh, and Tamai.

Esthonia.—With small but efficient naval forces the young Navy of Esthonia gallantly assisted the operations of Sir Walter Cowan, whereby the independence of Esthonia was secured. Rear-Admiral Johan Pitka was in command, and in token of the happy association King George conferred upon that officer the K.C.M.G. The Navy consists of two destroyers, with gunboats, launches and some other vessels, including also the ex-Russian gunboat Bobr, 875 tons, two 4·7-in. and four 12-pr. guns, completed in 1908, which has received the name of Lembit.

Finland.—The Finnish Navy is undergoing some development, and will doubtless become a small but efficient force. The ex-Russian gunboat Gilyak, 875 tons, two 4·7-in. and four 12-pr. guns, has been transferred to it.

Hayti.—Steel gunboat—Capois la Mort, 260 tons, 1 3·9-in., and 4 1-pr. Q.F. Iron corvette—Dessalines, 1200 tons, armed with 1 3·9-in. Q.F., 2 3·9-in. B.L., 2 l., 2 M. Two sloops—St. Michael and 1804. Gun-vessel, 22nd of December. Umbria, cruiser, of 2245 tons.

Mexico.—Two gun-vessels, Tampico and Vera Cruz, launched Elizabethport, New Jersey, 1902; displacement, 980 tons; armament, 4 4-in. Q.F., 6 6-pr.; bow torpedo tube; 2400 I.H.P.; speed, 16 knots; fitted to serve as transport for 200 troops. Gun vessels Bravo and Morero, 1200 tons; 2600 I.H.P.; Blechynden boilers; 17 knots; launched Leghorn, 1904. The Zaragoza, 1200 tons, 1300 H.P., 15 knots speed, and armed with 4 4·7-in. guns and 4 small quick-firing guns. Gun-vessel, Democrata, 450 tons; 11 knots; 2 6½-in. muzzle-loaders and 2 small guns. Torpedo transport General Guerrero, 1880 tons; 1200 I.H.P.; completed at Barrow 1908. Two small gunboats of 10 knots speed. Five torpedo-boats. Two cruisers, 2400 tons, to be built.

Peru.—Almirante Grau and Coronel Bolognesi, cruisers, 3200 tons, 370 ft. long, 40 ft. 6 in. beam, 14 ft. 3 in. draught; Barrow, 1906; 2 6-in., 8 14-pdr., 8 1¼-pdr.; 2 submerged torpedo tubes; 1½-in. armoured deck, 3-in. conning tower; 14,000 I.H.P.; 24 knots. Eclaireur, cruiser, 1769 tons, launched 1877, partially reconstructed, bought from France. Armoured cruiser Dupuy de Lôme, purchased for £140,000, and renamed Elias Aguirre. Lima, 1700 tons, 1800 I.H.P., 16 knots; armament, 2 6-in. guns. Destroyer, Rodriguez, 500 tons, and submarines, Ferré and Palacios, built Le Creusot, 1912–13. Screw steamer, Santa Rosa, about 400 tons.

Poland.—The Polish Government hopes eventually to become possessed of a small Navy, and at its request a small British Mission, under direction of Commander E. L. Wharton, R.N., has been advising the Polish authorities on such matters as the organisation of docks, the direction of maritime traffic, mine-sweeping, river police and the like. It is proposed that Poland shall be allowed six small cruisers and gunboats on the Vistula. She has been allotted six ex-German torpedo boats for police purposes.

Portugal.—The most considerable vessel in the Portuguese Navy is the cruiser Almirante Reis, completed at Elswick in 1899; 4100 tons, 12,000 H.P.; four 5·9-in., eight 4·7-in., fifteen smaller guns, five tubes; 22 knots. The Adamastor, 1962 tons, completed at Leghorn in 1897, and the São Gabriel at Havre in 1899, have as their chief armament, two 5·9-in. and four 4·7-in. guns. The Dom Luiz, Save, Patria, and Lurio are gunboats for Mozambique and Timor. The mine-layer Vulcano was built by Messrs. Thornycroft in 1909. There are other small boats, and the Acacia and some sloops sold out of the British Navy are being added. Portugal has the old destroyer Tejo and four modern, Douro, Guadiana, Vouga, and Tamega (1912–15), 700 tons, 11,000 H.P., 20 knots, two tubes. Submarines Espadarte, 245–300 tons, 13 knots (F.I.A.T.), and Foca, Golfinho, and Hidra (Laurenti).

Roumania.—Elizabeta, protected cruiser (deck 3 in.), built in 1887 at Elswick; 230 ft. long, 32 ft. 10 in. beam; 1320 tons; 3000 I.H.P.; armament, 4 5·9-in. B.L.R., 4 Q.F., 2 M., 4 torpedo tubes. Composite gunboat Mircea, 360 tons; Grivitza, 110 tons. For the Danube, the gunboats Fulgurul, Oltul, Siretul, Bistritza, 90 to 100 tons, Alexandru cel Bun, 104 tons, 5 sloops, and the river monitors Lascar Catargi, Ion Bratianu, Mihail Kogalniceanu, and Alandro Lahovary (600 tons), 3 4·7-in. guns. Two destroyers Naluka and Sborul, built at Havre, 1888; 578 tons, two torpedo tubes, 21 knots. Four destroyers built at Naples, 1350–1450 tons, of which two have been commissioned. Seven 100-ft. torpedo-boats built on the Thames; four by Schichau, 1904, for the Danube: Vedea, Argosul, Trotosul, Teleorman.

Russia.—The tables of the Russian battleships and light cruisers appeared in the Naval Annual of 1919, at pp. 322–25, and of the flotillas at pp. 365–66. They are not repeated in the present volume. They represent very powerful forces, and we cannot assume that those forces are now of no account. The following notes are made in relation to them. The Soviet Government has shown great power of organisation and administration in military concerns, and is not likely to underestimate the value of the naval forces which it controls, however much mutiny and sabotage may have damaged them.

In the Baltic the four battleships Gangut, Poltava, Petropavlovsk, and Sevastopol, 23,000 tons, twelve 12-in. guns, 18 knots, launched in 1911, were completed in 1915. In the latter year the battle-cruisers Borodino, Ismail, Kinburn, and Navarin, 32,000 tons, twelve 14-in. guns, 27 knots, were launched, but there is no news of their completion. Their guns have possibly been employed in long-range work on shore. The older battleships Andrei Pervozvannyi, Grazhdanin, Respublika, each four 12-in. guns, remain, and there are the armoured cruisers Gromoboi, Rossia, Rurik, Bayan, and Admiral Makaroff. The last named was erroneously stated to have been lost by striking a mine at the entrance to Reval harbour. The Soviet Government also disposes of the light cruisers Aurora, Bogatyr, Boutakoff, Diana, Grieg, Oleg, Spiridoff, and Svietlana. The Varyag was sold in England to be broken up. The Askold is at present under British control, and a Russian cruiser has been interned in America. The gunboat Bobr has passed to Esthonia, and the Gilyak to Finland.

The Soviet Government possesses about ninety destroyers in the Baltic, thirty of them built in and since 1914. A dozen boats had been sunk or otherwise destroyed. The Finn has been renamed Karl Liebknecht; and the destroyer built out of funds contributed by the Emir of Bokhara, which bore his name, has been named Yakob Sverdloff to honour the notorious Bolshevist leader.

The list of submarines in the Baltic given in last year's "Annual" requires considerable alteration. With the exception of the Graf Scheremetieff (which has doubtless been renamed) and the Kassatka, Makrel, Okun, and Minoga, all have disappeared. On the other hand, fourteen submarines built between 1914 and 1917 have been added. These are the Zmieya, Yoz, Forel, Yersh, Volk, Vepr, Keta, Kuguor, Leopard, Pantera, Ruis, Tigr, Tur, and Jaguir. They are from 220 to 223 feet long, with 14 ft. 6 in. beam and 12 ft. 7 in. draught, 650–784 tons displacement, 500–840 H.P., 10–9 knots, 40 tons oil-fuel, and four torpedo tubes and dropping gear. The four first named have greater H.P. and surface speed, 2640–900 and 16–9 knots.

In the Black Sea, where some of the naval forces were controlled by the Government of General Wrangel, very serious damage was done to the most powerful ships by elements hostile to the *de facto* Government. On April 25, 1919, by explosive means, the main engines were wrecked or destroyed of the five battleships Sviatoi Evstafi, Ioann Zlatoust, Rostislav, Boretz za Svobodu, and Tri Sviatitelia. The heavy guns have been removed from the old battleship Georgi Pobiedonosetz, and from the injured ships or some of them, and were sent up to the front of the Armies. Probably the only battleship now remaining effective is the Volya, twelve 12-in. guns, formerly the Alexander III., which General Wrangel renamed General Alexieff. The Demokratiya, a sister ship, launched in 1915, originally known as Ivan Grozny, and afterwards as Nikolai I., was in Bolshevist hands at Nikolaieff.

Before his defeat, General Wrangel's light cruisers were the Otchakoff, which he renamed General Korniloff, and the Pamyat Mercuria. The light cruiser Admiral Nakhimoff, fifteen 5·1-in. guns, 32 knots, was launched at Nikolaieff in 1915, and the Lazareff in 1916. The Admiral Korniloff and the Istomin were recently on the stocks at the same port.

The Wrangel Government had sixteen destroyers, 1908–14, ten of those which were in the list last year having been lost or destroyed, and of the submarines only two remain, the Nerpa and Tiulen. On the other hand, six submarines have been built, of which three were controlled by General Wrangel. These were the Utka, 650–784 tons, 500–900 H.P., 10–9 knots, fuel 40 tons, four torpedo tubes; the Borgevestnik, 2640–900 H.P., 16–9 knots, same armament; and the A.E. 22, of which the details are unknown. The Bolshevists held the A.E. 23, and also two sisters of the Borgevestnik, named Lebed and Pelikan, which at the present time of writing are sunk in Odessa harbour.

With regard to the destroyers in the Far East, no definite distribution is believed to have been arrived at, but the Grozovoi and Vlastni are now in British hands. The others are the Bespochtchadni, Bestrachni, Beschumni, and Boiki.

Santo Domingo.—The Independencia, built in England 1894, 170 ft. long, 25 ft. broad, displacement 322 tons, and armed with seven Hotchkiss quick-firing guns. Restauracion, steel gun-vessel, 1000 tons, launched at Glasgow in 1896. The 14-knot cruiser Presidente has been reconstructed, and carries seven guns.

Sarawak.—Two gunboats, of 175 and 118 tons respectively.

Serbo-Croatia-Slovenia.—The Jugo-Slavs have had allotted to them eleven ex-Austrian torpedo-boats, to be used for police purposes. They have claimed some ex-Austrian monitors on the Danube.

Siam.—Deck-protected cruiser Maha Chakrkri, 290 ft. long, 39 ft. 4 in. beam, of 2500 tons displacement and 17 to 18 knots speed; armament, four 4·7-in. and ten 6-pdr. quick-firing guns. Makut-Rajakamar, 650 tons. The gunboats Bali, Muratha, and Sugrib, 600 tons, one 4·7-in. Q.F., five 2·2 in., four 1·4 in., 12 knots, launched 1898 and 1901. Several other gunboats. Three modern despatch vessels 100 to 250 tons. Three 380-ton, 27-knot destroyers, built at Kobe. Phra Ruan (*ex* British destroyer Radiant, 1917).

Uruguay.—Gunboats: General Artigas, 274 tons, 12½ knots speed, 2 4·7-in. (Krupp), 2 M.; and General Saurez, 300 tons. The cruiser Uruguay, built at the Vulcan Yard, Stettin; 1100 tons; 2 4·7-in., 4 12-pdr., 12 Maxims; 2 18-in. torpedo tubes; 5700 I.H.P.; 23 knots.

Venezuela.—Gunboats Bolivar, 571 tons, 18·6 knots, and Miranda, 200 tons, 12 knots; transports Restaurador, 568 tons, and Zamora, 350 tons. Maresa Sucre (ex Isla de Cuba), drill ship, bought from United States, 1912.

BRITISH AND FOREIGN FLOTILLAS.

Great Britain.

Name or Number.	Built by.	Completed.	Dimensions.			Number of Screws.	Displacement.	Horse-Power.	Mean Speed on Trial, or expected.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			FLOTILLA LEADERS.										
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
*Abdiel			315	31·9	10	3	1610 to 1680	36,000	34	4–4 in. Q.F. 2–2 prs.	4	110 to 116	Oil. 515
Gabriel	Cammell Laird ..	1916											
Ithuriel													
Parker													
Grenville													
Seymour..	,, ,, ..	1916											
Saumarez													
Valkyrie	Denny	1917	300	29·6	9	2	1320 to 1340	27,000	34	4–4 in. Q.F. 1–3 in. A.A.	4	116	Oil. 367
Valorous	,, ...												
Valentine	Cammell Laird												
Valhalla..	,, ,,												
Vampire	J. S. White ..												
Shakespeare	Thornycroft ..	1917	318	31·9	10·6	2	1750	43,500	36·5	5–4·7 in. 1–3 in. A.A.	6	164	Oil. 500
Spenser	,, ..	1917											
Wallace	,, ..	1919											
Keppel	,, ..	Bldg.											
Rooke	,, ..	Bldg.											
Bruce			320	31·9	10·6	2	1800	44,000	36·5	5–4·7 in. 1–3 in. A.A.	6	164	Oil. 500
Douglas													
Campbell													
Mackay *ex*-Claverhouse	Cammell Laird ..	1918											
Malcolm..													
Montrose	Hawthorn	1918											
Stuart	,, ...	1919											
Pl. 18.													

* Fitted as mine-layer.

TORPEDO BOAT DESTROYERS.

"*R*" *Class*:—Rapid, Ready, Retriever, Rosalind, Taurus, Teaser (Thornycroft); Relentless, Rival, Sabrina, Sybille, Truculent Tyrant (Yarrow); Radstock, Raider, Sorceress, Torrid, Tower (Swan, Hunter); Redgauntlet, Rob Roy, Rocket (Denny); Redoubt, Umpire (Doxford); Restless, Rigorous, Romola, Rowena, Simoom, Skate, Tarpon, Telemachus (John Brown); Salmon, Sylph, Skilful, Springbok, Tenacious, Tetrarch (Harland and Wolff); Sable, Trenchant, Tristram (White); Sarpedon, Starfish, Stork, Thisbe, Thruster (Hawthorn); Satyr, Sharpshooter, Tancred, Ulster (Beardmore); Sceptre, Sturgeon, Tormentor (Stephen); Tempest, Undine (Fairfield).

Displacement, 883–1040 tons; length, 260–265 ft.; 26,500–27,000 H.P.; speed, 35–36 knots; armament, three 4-in., one 2-pdr., four torpedo tubes; fuel, 256–300 tons; complement, 82.

"*S*" *Class*:—Sabre, Saladin, Sardonyx (Stephen); Scimitar, Scotsman, Scout, Scythe, Seabear, Seafire, Searcher, Seawolf (John Brown); Senator, Sepoy, Seraph, Serapis, Serene, Sesame (Denny); Shamrock, Shikari (Doxford); Shark, Sparrowhawk, Splendid, Sportive, Tilbury, Tintagel (Swan, Hunter); Steadfast, Stirling, Stonehenge, Stormcloud (Palmers); Strenuous, Stronghold, Sturdy, Swallow (Scotts); Tactician, Tara (Beardmore) Tenedos, Thanet, Thracian, Turbulent (Hawthorn); Speedy, Tobago, Torbay, Toreador, Tourmaline, (Thornycroft); Tribune, Trinidad, Trojan, Truant, Trusty (White); Torch, Tomahawk, Tumult, Turquoise, Tuscan, Tyrian (Yarrow).

Displacement, 885–1090 tons; length, 260–265 ft.; 27,000 H.P.; speed, 36 knots; armament, three 4-in., one 2-pdr., six torpedo tubes; fuel, 250–300 tons; complement, 90.

"*V*" *Class*:—Vancouver, Vanessa, Vanity (Beardmore); Vanoc, Vanquisher (J. Brown); Vectis, Vortigern (White); Vega, Velox (Doxford); Vendetta, Venetia (Fairfield); Venturous (Denny); Verdun, Versatile (Hawthorn); Vesper, Vidette (Stephen); Viceroy, Viscount (Thornycroft); Violent, Vimiera (Swan, Hunter); Vivacious, Vivien (Yarrow).

Displacement, 1275–1300 tons; length, 300 ft.; H.P., 27,000–30,000; speed, 34–35 knots; armament, four 4-in., one 3-in., four torpedo tubes; fuel, 367 tons; complement, 110.

"*W*" *Class*:—Voyager (Stephen); Wakeful, Watchman, Venomous, Verity, Veteran (J. Brown); Walker, Westcott, Volunteer (Denny); Walpole, Whitley (Doxford); Walrus, Wolfhound, Wanderer (Fairfield); Warwick, Wessex (Hawthorn); Westminster (Scotts); Wolsey, Woolston, Wishart, Witch (Thornycroft); Vansittart (Beardmore); Winchelsea, Winchester, Witherington, Wivern, Wolverine, Worcester (White); Whirlwind, Wrestler, Whitehall, Whitshed, Wild Swan (Swan, Hunter); Waterhen, Wryneck (Palmers); Wren (Yarrow).

Displacement, 1275–1350 tons; length, 300 ft.; H.P., 27,00; speed, 34 knots; armament, four 4-in., or four 4·7-in., and one 3-in.; six torpedo tubes; fuel, 365 tons; complement, 127.

SLOOPS.

Of the large number of sloops which were built during the War for patrol and other duties only about twenty now remain in the Post-War Fleet, some in commission abroad and others for subsidiary and training duties in home waters.

Names are as follow; Bluebell, Bryony, Camellia, Clematis, Cornflower, Chrysanthemum, Dianthus, Foxglove, Godetia, Gardenia, Harebell, Heather, Heliotrope, Hibiscus, Hollyhock, Laburnum, Lupin, Magnolia, Snapdragon, Valerian, Verbena, Veronica. Also Petersfield (*ex*-mine-sweeper).

Displacement, 1250 tons; length, 255 ft.; H.P., 2400; speed, 17 knots; armament, two 4-in., two 3-pdrs.; 260 tons of coal; complement, 93.

TWIN-SCREW MINE-SWEEPERS.

The following are retained in the Post-War Fleet:—

Alresford, Carstairs, Caterham, Sherborne, Mistley, Burslem, Truro, Badminton, Tring, Leamington, Albury, Caerleon, Camberley, Dorking, Dundalk, Dunoon, Elgin, Faversham, Fermoy, Ford, Forres, Gaddesden, Gainsborough, Gretna, Irvine, Kendal, Lydd, Mallaig, Malvern, Marlow, Meynell, Munlochy, Nailsea, Newark, Northolt, Pangbourne, Prestatyn, Ross, Rugby, Saltash, Saltburn, Selkirk, Shrewsbury, Stafford, Sutton, Swindon, Tiverton, Tonbridge, Tralee, Weybourne, Yeovil.

Most of the foregoing form a "Central Reserve of Twin-Screw Mine-sweepers." In addition, the following are employed on surveying duties:—

Beaufort, Collinson, Crozier, Fitzroy, Flinders, Kellet.

Displacement, 800 tons; length, 220 ft.; H.P., 2200; speed, 16 knots; armament, two 12-pdrs., two 2-pdrs.; 140 tons of coal; complement, 74.

PATROL BOATS.

The following are retained in the Post-War Fleet:—

P 31, P 38, P 40 P 46, P 47, P 48, P 52, P 59, PC 43, PC 56, PC 60, PC 70, PC 71, PC 72, PC 73, PC 74.

Displacement, 573 tons; length, 230 ft.; H.P., 4000; speed, 22 knots; armament, one 4-in., one 2-pdr., two 14-in. tubes; oil, 93 tons; complement, 54.

SUBMARINES.

The submarines retained in the Post-War Fleet are 98 in number. All the vessels of the A, B, C, D, F, S, V, and W types have been scrapped; ~~all the early E boats up to and including E 22~~; and also certain vessels of later classes; while all the surviving boats of the J type have been transferred to the Royal Australian Navy.

"E" Class:—E 23, E 27, E 31, E 32, E 33, E 35, E 38, E 39, E 40, E 41, E 42, E 44, E 45, E 46, E 48, E 51, E 53, E 55.

Surface displacement, 660 tons, submerged, 800; surface H.P., 1600, submerged, 840; surfacee speed, 15 knots, submerged, 10 knots; oil, 45 tons; armament, one 3-in., five 18-in. tubes; complement, 30.

"G" Class:—G 3, G 4, G 5, G 6, G 10, G 13.

Surface displacement, 700 tons, submerged, 975; surface H.P., 1600, submerged, 840; surface speed, 14 knots, submerged, 10 knots; oil, 44 tons; armament, one 3-in., four 18-in., and one 21-in. tubes; complement, 30.

"H" Class:—H 21, H 22, H 23, H 24, H 25, H 26, H 27, H 28, H 29, H 30, H 31, H 32, H 33, H 34, H 42, H 43, H 44, H 47, H 48, H 49, H 50, H 51, H 52.

Surface displacement, 440 tons, submerged, 500; surface H.P., 480, submerged, 320; surface speed, 13 knots, submerged, 10½ knots; oil, 16 tons; armament, fonr 21-in. tubes; complement, 22.

"K" Class:—K 2, K 5, K 6, K 8, K 9, K 10, K 11, K 12, K 14, K 15, K 16, K 22.

Surface displacement, 1880 tons, submerged, 2650; surface H.P., 10,000, submerged, 1400; surface speed, 24 knots, snbmerged, 9 knots; oil, 200 tons; armament, one 4-in., one 3-in. A A., eight 18-in. tubes; surface propulsion by steam turbines; complement, 54.

"L" Class:—L 1, L 2, L 3, L 4, L 5, L 6, L 7, L 8, L 9, L 11, L 12, L 14, L 15, L 16, L 17, L 18, L 19, L 20, L 21, L 22, L 24, L 25, L 33, L 52, L 56, L 71.

Surface displacement, 890 tons, submerged, 1070; surface H.P., 2400, submerged, 1600; surface speed, 17½ knots, submerged, 10½ knots: oil, 76 tons; armament, one 3-in. or 4-in., six 18-in. tubes. (L 52 and later boats have two 4-in. guns each.); complement, 38.

"M" Class:—M 1, M 2, M 3. Details not published. One 12-in. gun; complement, 65.

"R" Class:—R 1, R 2, R 3, R 4, R 7, R 8, R 9, R 10, R 11, R 12.

Surface displacement, 420 tons, submerged, 500; surface H.P., 1200, submerged 240; surface speed, 15 knots, submerged, 9½ knots oil, 13 tons; complement, 22.

Argentine Republic.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
DESTROYERS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Corrientes	Yarrow ..	1896	190	19·6	7·4	2	280	4,000	27·4 *t.*	1 14-pr. 3 6-pr, Q.F., 2 M.	3	54	80
Misiones..	Yarrow ..	1896	190	19·6	7·4	2	280	4,000	26·0 *t.*		3	54	80
Entre Rios	Yarrow ..	1896	190	19·6	7·4	2	280	4,000	26·7 *t.*		3	54	80
Catamarca, Jujuy ..	Germania ..	1911	286·7	27·1	8·6	2	940	18,000	32	4 4-in.	4	110	250*
Cordoba, La Plata ..	Schichau ..	1911	279	29·6	7·3	..	890	19,000	34·7	4 4-in.	4	110	290*
FIRST CLASS—													
2 boats	Thornycroft	1890–1	150	14·5	5·2	2	110	1,500	24·52	3 3-prs.	3	27	22
6 boats	Yarrow ..	1890	130	13·5	6	1	85	1,200	23–24	2 3-pr. Q.F.	2	15	15

Four 950-ton destroyers building at Nantes were taken over for the French Navy in 1914.
The two 150-ft. boats are named Comodoro Py and Murature.
The six 130-ft. boats are named Bathurst, Buchardo, Jorge, King, Pinedo, and Thorne.
* Also oil fuel 50–110 tons.

Brazil.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
DESTROYERS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Para	Yarrow ..	1908	240	23·6	10	2	550	7,014	27·25	2 4-in., 4 3 prs.	2	..	140
Amazonas		1908						6,898	27·17				
Piahuy		1908						6,563	27·21				
Matto Grosso		1908						7,403	27·16				
Parahyba..		1909						6,700	27·29				
Rio Grande do N. ..		1909						7,778	27·27				
Alagoas		1909						7,403	27·25				
Santa Catharina ..		1909						6,982	27·30				
Parana		1910						8,877	28·74				
Sergipe		1909						8,554	27·60				
FIRST CLASS—													
Goyaz	Yarrow ..	1907	152·5	15·3	..	3	..	..	26·5	2–3 prs.	2	..	..

Five additional destroyers and three large submarines are proposed.
Three submarines have been completed at Muggiano (F.I.A.T.), Medusa type improved (250–370 tons, 14–8·5 knots). A Special Laurenti submarine salvage and testing vessel, named Caera, 3800 tons, 328 ft. long, 50 ft. beam.

Chile.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
DESTROYERS—													
Almirante Lynch, Condell	White	1912 1913	320	32·6	11·1	3	1850	27,000	31·7	6-4-in. 2 M.	4	..	507
Almirante Riveros (*ex*-Broke) Almirante Uribe (*ex*-Faulknor) Almirante Williams (*ex*-Botha)	White	1914	320	32·6	11	3	1700 to 1740	30,000	31·5	2-4·7-in., 2-4-in., 1 6-pr.	4	160	486
Tome, Talcahuáno	Laird	1898	238·8	27·9	9·8	—	750	4,500	20	3-3·8-in., 4-3-pr.	5	..	100
Capitan Orella	Laird	1896	210	21·6	5·4	2	300	6,000	30·17	1-12 pr. Q.F. 5-6 pr.	2	65	90
Capitan Munoz Gamero	Laird	1896	210	21·6	5·4	2	300	6,000	30·42	1-12 pr. Q.F. 5-6 pr.	2	65	90
Teniente Serrano	Laird	1896	210	21·6	5·4	2	300	6,000	30·35	1-12 pr. Q.F. 5-6 pr.	2	65	90
Guardia-Marina Riquelme	Laird	1896	210	21·6	5·4	2	300	6,000	30·09	1-12 pr. Q.F. 5-6 pr.	2	65	90
Capitan Merino Jarpa Capitan O'Brien	Laird	1901	210	21·6	5·4	2	350	6,000	30	Do.	2	65	90
Captain Thompson	Armstrong	19.2	..	..	..	2	480	5,600	28	6-6 pr.	2	83	90
FIRST CLASS—													
Injeniero Hyatt, Cirujano Videla, Injeniero Mutilla, Guardia-Marina Contreras, and Teniente Rodriguez (Viper type)	Yarrow	1896 1898	152·6	15·3	7·9	1	140	2,200	27·5-27·2	3-3 pr. Q.F.	3	28	48

Six submarines (Holland type) built for the British Government in 1915 were ceded to the Chilian Navy in 1917. They are numbered H 1 to H 6; 450–520 tons, 800 H.P., 15–18 knots, length 150 feet.

Denmark.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
FIRST CLASS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Havkatten, Sælen	Royal Dockyard, Copenhagen	1919	126·3	13·9	8·4	2	108·5	2,000	24·6	2 6-pr. A.A.	2	22	15
Nord Kaperen		1918											
Makrelen		1918											
Narhvalen		1917											
Havhesten, Söhunden		1917											
Sölöven, Stören		1916											
Springeren		1916											
Ormen		1907	124·6	14·3	8·5	1	105	2,100	26	2 1-pr.	3	21	11
Sværdfisken		1913	148·2	16·9	7·5	2	190	3,480	26·2	1 6-pr.	4	30	28
Delfinen, Hvalrossen		1913											
Soülven	Burmeister, Copenhagen	1911	181·7	18	9·7	2	275	5,000	27·5	2 12-pr.	5	33	55
Feyvefisken		1911											
Soridderen	Yarrow & Co.	1911											
Spaekhuggeren	Royal Dock., Copenhagen	1911	184·8	19·1	7·1	2	300	5,000	27·5	2 12-pr.	5	34	49
Vindhunden													
Tumleren	Schichau												

Three old torpedo boats rebuilt, 1902–8.

SUBMARINES—Bellona, Flora, Rota, 301–369 tons, 1 2·2-in. A.A., 4 t.t. Galathea, Neptun, Triton, Ran, Ægir, 185–235 tons, 13·5–9·8 kts., 1 2·2-in. A.A., 3 t.t. Nymfen, Najaden, Havfruen, Havmanden, Thetis, An den April, 167–204 tons, 13·5–8 kts., 2 M., 2 t.t.

France.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
DESTROYERS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Bélier	Nantes	1903	185·0	20·11	11·0	2	358	6,953	..	1-9pr. 6-3prs.	2	62	75
Bouclier	Normand	1911	237·0	24·9	9·4	3	790	13,000	35·33	2-25-pr.4-9pr.	4	62	160
Carquois	Rochefort	1907	197·4	21·5	11·4	2	347	6,800	28·15	19-pr.6 3-prs.	2	62	37
Casque	Havre(F.&C.)	1910	246·4	25	10·0	3	820	14,400	34·90	1 25pr.,4-9pr.	4	62	160
Cavalier	Normand	1910	222·0	21·8	10·5	3	527	8,600	31·19	4–9 prs.	2	62	150
Cimeterre	Bordeaux	1911	253·4	28·7	10·0	2	894	13,500	31·15	2-25pr.,4-9pr.	4	62	160
Claymore	Normand	1906	196·8	21·6	11·4	2	339	7,600	30·45	1-9pr. 6-3prs.	2	62	75
Cognée	Toulon	1907	197·0	21·6	11·4	2	397	6,800	27·04	1-9pr. 6-3prs.	2	64	75
Coutelas	Rochefort	1907	197·4	21	10·0	2	351	7,000	29·07	1-9pr. 6-3prs.	2	62	75
Epieu	Normand	1903	191·0	21	10·4	2	320	7,300	31·24	1-9pr. 6-3prs.	2	62	75
Escopette	Rochefort	1900	183·9	20·9	8·9	2	311	5,200	26·50	1-9pr. 6-3prs.	2	62	75
Fanion	Bordeaux	1908	197·0	21·7	11·5	2	360	6,800	29·06	1-9pr. 6-3prs.	2	..	..
Fanfare	Normand	1907	197.0	21·7	11·5	2	361	6,600	28·0	1-9pr. 6-3prs.	2	62	84
Fauconneau	Normand	1900	183·9	20·8	3·9	2	311	5,600	27·14	1-9pr. 6-3prs.	2	..	..
Francisque	Rochefort	1904	191·0	21	10·6	2	310	6,500	30·06	1-9pr. 6-3prs.	2	62	75
Glaive	Rochefort	1908	197·4	22·4	11·8	2	358	6,800	27·90	1-9pr. 6-3prs.	2	62	75
Hache	Toulon	1908	197·2	21·5	11·4	2	359	6,800	26·48	1-9pr. 6-3prs.	2	62	75
Harpon	Bordeaux	1902	191·0	21	10·6	2	314	6,600	30·7	1-9pr. 6-3prs.	2	62	75
Hussard	Lorient	1908	216·0	22·8	10·0	2	407	7,750	30·0	6–9 prs.	3	62	120
Lansquenet	Bordeaux	1909	221·2	20·8	10·0	3	542	8,129	28·8	6–9 prs.	3	62	150
Mameluck	Nantes	1909	216·0	22·8	10·0	2	407	7,750	30·5	6–9 prs.	3	62	150
Massue	Toulon	1908	197·2	21·7	11·4	2	350	7,128	28·4	1-9pr. 6-3prs.	2	62	75
Mortier	Rochefort	1906	197·4	21·5	11·3	2	347	6,800	29·5	1·9pr. 6-3prs.	2	62	75
Obusier	Rochefort	1906	185	21·5	11·2	2	344	6,800	28·3	1-9pr. 6-3prs.	2	62	75
Oriflamme	Nantes	1908	197	21·7	11·6	2	366	7,226	29·5	1-9pr. 6-3prs.	3	..	..
Pertuisane	Rochefort	1900	184	20·9	8·9	2	311	5,000	27	1-9pr. 6-3prs.	2	62	75
Pierrier	Rochefort	1907	197	21·5	11	2	332	6,800	27·1	1-9pr. 6-3prs.	2	62	75
Pique	Havre(F.&C.)	1900	186	21	8·9	2	313	5,600	25·5	1-9pr. 6-3prs.	2	62	75
Poignard	Rochefort	1909	197	22	11	2	358	6,800	28	1-9pr. 6·3prs.	2	62	75
Rapière	Rochefort	1901	189	21	10·5	2	317	5,200	26·8	1-9pr. 6-3prs.	2	62	75
Sabre	Rochefort	1904	191	21	10·5	2	312	6,500	29·7	1-9pr. 6-3prs.	2	62	75
Sagaïe	Havre(F.&C.)	1902	191	21	11	2	368	7,300	30·4	1-9pr. 6-3prs.	2	62	75
Sape	Rouen	1907	196·8	21·7	11·5	2	350	6,400	30	1-9pr. 6-3prs.	3	..	..
Spahi	Havre	1908	224	21·7	10	2	455	9,000	29·4	6–9 prs.	3	62	120
Tirailleur	Bordeaux	1908	207	22·8	9·6	3	479	7,800	27·3	6-9 pr.	2	62	120
Trident	Rochefort	1907	197·3	21·5	11	2	347	6,800	28·1	1-9pr. 6-3prs.	2	62	37
Com. Bory, Francis Garnier, Com. Rivière, Capt. Mehl, Dehorter (5)	Normand, &c.	1912	253·6	25·4	10·0	3	780	14,100	31	2 3·9-in., 4 9 prs.	4	81	120
Bisson Protet, Magon, Comm. Lucas, Mangini (4)	Toulon, etc.	1912 & 1913	272·4	26	10·0	3	800	15,000	31	2 3·9-in., 4 9 prs.	2 dbl.	81	120
Enseigne Henry, Aspirant Herbert (2)	Rochefort	1911 & 1912	221	21·6	10·3	2	475	7,500	28·5	6–9 prs.	4	62	50
Ens. Roux, M. P. Lestin, Ens. Gabolde (3)	Rochefort & Normand	1914–1915	271	26·9	10·0	2	880	20,000	31	2 3·9-in., 4 9 prs.	3 dbl.	81	..
TORPILLEURS D'ESCADRE—													
Téméraire, Intrepide, Opiniatre, Aventurier	France	1911	270	..	..	..	950	..	..	4 3·9 in.	4	..	..
Annamite, Algérien, Arab, Bambara, Hova, Kabyle, Marocain, Sakalave, Sénégalais, Somali, Tonkinois, Touareg	Japan	1917	272	24	7·10	..	685	10,000	29	1–4·9 in., 4–12 prs.	2 dbl.	..	..
SEA-GOING—													
Audacieux	Nantes	1900	144·2	15·2	10	2	185	4,200	26·1	2–3 prs.	3	..	18
Borée	Bordeaux	1901	152	17	8	2	178	3,900	29·5	2–3 prs.	2	..	18
Bourrasque	Normand	1901	147·7	16	8	2	160	4,400	31·4	2–3 prs.	2	..	18
Grondeur	Havre(F.&C.)	1892	147·5	14·5	8	2	130	1,750	23·8	2–3 prs.	2	27	20
Mistral	Normand	1901	153	17	8·8	2	186	4,018	28·2	2-3 prs.	3	..	23
Rafale	Normand	1901	147·7	17	8	2	167	4,400	31·1	2-3 prs.	2	..	18
Simoun	Havre(F.&C.)	1901	152·7	17	9	2	186	4,600	27·7	2-3 prs.	3	..	18
Siroco	Normand	1901	152·7	17	9	2	186	4,300	28·7	2–3 prs.	3	..	23
Tramontane	Bordeaux	1901	152·7	17	9	2	162	3,900	29·8	2-3 prs.	2	..	18
Trombe	Nantes	1900	147 8	17	8·8	2	185	4,200	26	2–3 prs.	3	..	18
Typhon	Havre(F.&C.)	1901	152·7	17	8	2	186	4,600	27·7	2–3 prs.	3	..	18

N.B.—F. & C., Forges et Chantiers. Normand means that the boat has been built at that firm's yard at Havre.

Twenty-one destroyers and 2 sea-going torpedo-boats have recently been condemned or scrapped. They have been removed from these lists.

The surrendered German flotilla leader S 113 has been added to the French fleet, as also the following eleven destroyers: V 46, 79, 100, 126, 130; S 133, 134, 135, 139; and H 146 and 147; also the Austrian destroyer Dukla.

TORPEDO BOATS.—The following are the numbers of the existing torpedo boats (86-100 tons) built 1899-1906. It has been decided that 8 of them shall not be taken in hand for any extensive refit: 222, 231, 238, 243, 250, 252, 258, 259, 274, 276, 278, 279, 280, 288, 296, 297, 299, 301, 302, 304, 308, 310, 312, 313, 315, 316, 318, 321, 322, 326–329, 330, 332, 337, 339, 341, 342 349–352, 357, 360–362, 365–369.

France—*continued.*

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.
			Length.	Beam.	Draught.							
			Feet.	Feet.	Feet.		Tons.		Knots.			
Submarines—												
Nivôse, Brumaire, Frimaire	Cherbourg ..	1907 to 1912	170·8	18·0	10·3	2	398	700	9½–12¼	..	7	24
Euler, Franklin, Faraday, Volta, Newton, Montgolfier, Arago, Curie, Le Verrier	Cherbourg .. Rochefort .. Toulon ..	1909 1912	160	16·4	13·6	2	398	340	7½–12¼	..	7	24
Clorinde, Cornélie, Amphitrite, Astrée, Artémis, Aréthuse, Atalante, Amaranthe, Andromaque	Rochefort ..	1913 & Bldg.	174	16·9	10·9	2	410	1,300	15·8	..	8	20
Néréide	Cherbourg ..	1913	243	19·8	14·4	2	787–1000	4,800	10–20	..	8	40
Bellone, Hermione, Gorgone	Rochefort .. Toulon ..	1914 & 1915	198·9	17·7	11·9	2	520	1,800	17	..	8	29
Daphne..	Cherbourg ..	1915	223	18·0	12·0	2	633	1,800	15·1	1-75mm., 1 M.	10	..
Joessel, Fulton	Cherbourg ..	1917	243	20·0	13·4	2	870	..	16·8	2-75mm., 1 M.	10	..
Laplace .. .. Lagrange, Regnault .. Romazzotti	Rochefort .. Toulon .. Toulon ..	1917 1917 1918	247	21·0	13·0	2	840	..	16·5	,, ,,	10	..
Amazone, Antigone ..	Schneider ..	1918	184·6	17·0	10·6	2	665-467	2,000	17·5	1-2 pr., 1 M.	6	..
O'Byrne, L. Dupetit-Thouars, Henry Fournier	Chalons ..	1919 & Bldg	172	15·6	9·6	..	335-502	1020-460	8·14	1 gun ..	4	..
Paul Chailley	Havre	Bldg.	246	..	..	..	866–1171	1800–1400	13·5–85	1-12 pr., 2 M. 64 mines	4	..
Maurice Callot	Bordeaux ..	Bldg.	246	..	..	..	861–1211	2900-1600	17–10	1-12 pr., 2 M. 64 mines	4	..

Ten of the German submarines surrendered are being embodied in the French flotilla: U 105, 108, 139, 162, 166; U.B. 94, 99, 105; U 79, 119, mine-layers.

Fifty-three submarines have been removed from the list, including the Gustave *Zédé*, Dupuy du Lôrne, Sané and Armide recently condemned. The Curie, captured by the Austrians at Pola, 1914, has been recovered.

Greece.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Coal Capacity.
			Length.	Beam.	Draught								
Destroyers—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Nafkratoussa .. Thyella .. .. .. Sphendoni .. .. Lonchi	Yarrow ..	1906	220	20·6	7·2	2	350	..	32·1 31·79 31·84 32·53	2 12, 4 6-pr.	2	58	80
Nike.. . .. .. Aspis .. .. .. Velos	Stettin (Vulcan)	1906	220	20·6	7·2	2	350	..	30	2 12, 4 6-pr.	2	58	80
Aetos, Leon, Panthir, Jerax ..	Birkenhead	1911	285	29·9	9·6	..	980	19,750	32	4 4-in.	4	110	225
Keravnos .. .. .. Nea Genea	Stettin ..	1911	..	..	..	..	750	..	32·5	4 3·4-in.	2	..	..
Submarines—													
Delphin, Xiphias ..	Chalon sur Saône ..	1911–12	164	..	..	..	300–460	..	14·9	..	5	..	..

Six 125-ton torpedo-boats built by the Vulcan Co. at Stettin: Arethusa, Doris, Aigli, Dafni, Alcyon, Thetis.

Two Laubeuf type submarines building at the Schneider works, Le Creusot, were taken over for the French Navy.

The surrendered Austrian destroyer Ulan, has been added to the Greek Navy, as also, for police duties, the torpedo-boats: F 92, 94, 95, 96; and M 98, 99, 100.

Italy.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Destroyers—													
Fulmine	Sestri (Odero)	1898	200	20·4	5·4	2	298	4,800	28	5 6-pr. Q.F.	2	43	60
Euro	Elbing (Schichau)	1901	196·8	21·3	5·8	2	320	6,000	30	1 14-pr. Q.F., 5 6-pr.	2	53	60
Aquilone	Naples (Pattison)	1901	210	19·4	7·6	2	330	6,000	30	5 6-pr. Q.F.	2	53	60
Zeffiro .. .. .. Espero	Naples (Pattison)	1904	210	19·4	7·6	2	330	6,000	30	5 6-pr. Q.F.	2	53	60
Bersagliere .. .. Artigliere.. .. .. Granatiere .. .. Lanciere .. .. .. Alpino .. .. .. Corazziere .. .. Pontiere .. .. . Carabiniere .. .. Fuciliere	Genoa (Ansaldo)	1906 1907 1909 1910	211·6	20·0	7·6	3	365	6,000	30	4 14-pdr.	3	55	82
Impavido.. .. .. Indomito .. .. .. Insidioso .. .. .. Irriquieto..	Naples (Pattison)	1912 & 1913	246	24·6	7·6	..	650	15,000	35·2	1 4·7 in. 4 14-pr.	2	..	100
Ardito .. .. .. Ardente .. .. .. Animoso	Orlando (Legborn)	1912 & 1913	246	24·6	7·6	..	650	15,000	35·5	1 4·7 in. 4 14-pr.	2	..	..
Ascaro	Ansaldo ..	1912	211·5	20·0	6·6	..	380	6,000	29	2 14-pr. 4 6-pr.	3	..	80
Francesco Nullo .. Antonio Mosto .. Guiseppe Sirtori .. Giacinto Carini ..	Naples (Pattison)	1913 & 1914	238	24	8·9	..	770	18,000	33	4 4-in., 2 14-pr., 2 M. Carry also 10 mines	2 dbl.	100	170
Rosolino Pilo .. .. Guiseppe Abba .. Simone Schiaffino .. Pilade Bronzetti .. Guiseppe Missori .. Ippolito Nievo.. ..	Genoa (Odero)												
Francesco Stocco .. Giovanni Acerbi .. Vincenso Orsini .. Guiseppe la Masa .. Angelo Bassini .. Nicola Fabrizi .. Giacomo Medici ..	..	1913 & 1914	238	24	8·9	..	170	18,000	33	4 4-in., 2 14-pr., 2 M. Carry also 10 mines	2 dbl.	100	170
Audace	Yarrow ..	1918	..	..	..	..	1085	21,500	30	7 4-in., 2 2-pr., A.A.	4 dbl.	111	240
First Class—													
Sirio, Sagittario .. Spica	Elbing ..	1905–6	164	19·6	6·3	2	215	2,900 3,250	25	2 3-pr.	2	..	40
Alcione, Ardea .. Albatros, Aiorone .. Astore, Arpia	Odero	1905 1906											
Orione, Orsa, Orfeo ..	Genoa (Ansaldo)	1906											
Gabbiano	Spezia.. ..	1907	164	17·4	7·0	2	200	3,000	25·4 26·6	3 3-pr.	3		40
Pegaso	Naples (Pattison)	1905											
Procione	Naples (Pattison)	1905											
Pallade													
Cigno													
Cassiopea		1906											
Calliope		1907											
Clio		1906											
Centauro		1907											
Canopo		1907											
Calipso	Naples (Pattison)	1909											
Climene		1909											
1 P.N.-12 P.N.* ..	Pattison ..	1912 & 1913	139	13·9	..	..	130	2,500	27	1 6-pr.	2	..	..
13 O.S.-24 O.S. ..	Odero												
25 A.S.-32 A.S. ..	Ansaldo ..												
33 P.N.-38 P.N. ..	Pattison ..												
39 R.M.	Spezia.. ..	1914											
Additional boats of this class 40–45, 64–69 P.N. (Pattison); 46–51 O.S. (Odero); 52–57 A.S. (Ansaldo), 58–63, 74–75 O.L. (Orlando).													

For flotilla leaders, including the surrendered German V 116, used as scouts, see cruiser list. Also Arno, 600 tons, 30 knots (built for Portugal), and four of 1450 tons, 35 knots, three 4·7-in., seven 12-pr. (for Roumania), and taken over.

The ex-German destroyers B 97 and S 63 have been added to the Italian Navy, also the ex-Austrian destroyers Lika, Uszok, Triglav, Orgen, Csepel, Balaton, and Tatra.

*** P.N. 5, 17, and 36, and O.S. 7 have been lost from these series.**

Italy—*continued.*

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
SUBMARINES—													
Galvani, Torricelli, P. Micca .. .. L. Mocenigo .. .. L. Marcello .. .. A. Emo .. .. .. A. Pacinotti .. .. A. Barbarigo .. .. A. Provana .. .. S. Veniero .. .. G. Nani	Spezia .. .. Venice.. .. Spezia, F.I.A.T. Spezia, F.I.A.T.	1915 1918	..	..	..	..	700 1000	2600	16-10	2 14-pr. A.A.	5	..	..
Arganauta, X 2, 3 ..	Ansaldo ..	1915	..	..	..	..	179 200	80 202	7-5	..	..	..	..
H 1 to 4, 6 to 8 ..	Vickers ..		..	..	..	..	..	400 460	13–11	..	..	22	14
F 1, 2, 5, 6, 7, 9, 10, 12–21	F.I.A.T. .. Odero .. .. Orlando ..		..	..	..	..	260 380	600 450	13–8·5	1 3-in. A.A.	2	..	12

N 1–6 additional submarines.

Japan.

Name or Number.	Where Built.	Launched.	Dimensions			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
DESTROYERS—													
Murakumo, Shinonome, Yugiri, Shiranui, Kagerou, Usugumo	Thornycroft	1898–1900	210·0	19·5	5·7	2	307	5,800	30 to 31	1 12-pr., 5 6-prs.	2	54	80
Shirakumo, Asashio	Thornycroft	1901–2	216·7	20·7	6·0	2	373	7,400	31	1 12-pr., 5 6-prs.	2	59	96
Akebono, Sazanami, Oboro, Niji, Kasumi	Yarrow ..	1899–1902	220·0	20·6	5·2	2	311	6,000	31	1 12-pr., 5 6-prs.	2	55	95
Asagiri, Murasame	Yokosuka ..	1902	220·3	20·6	6·0	2	374	6,000	29	1 12-pr., 5 6-prs.	2	..	..
Yamahiko, Fumizuki Satsuki	Port Arthur Petrograd ..	1913	196·9	18·4	5·2	2	250	6,000	27	1 12-pr., 5 3-prs.	2	..	80
Hatsushima, Yayoi, Kisaragi, Hibiki, Wakaba, Hatsuyuki, Kamikaze, Ariake	Yokosuka ..	1905–6	220·3	20·6	6·0	2	374	6,000	29	6 12-pr.	2	..	..
Fubuki, Arare .. Yunagi, Oite .. .. Asakase, Harukuse Shigure, Hatsuharu Yuguri, Yudachi .. Mikadzuki, Nowake Uschio, Nenohi .. Shiratsuyu	Yokosuka .. Maizuru .. Kobe .. .. Sasebo.. .. Kure .. .. Nagasaki ..	1905–6	220·3	20·6	6·0	2	374	6,000	29	6 12-pr.	2	..	..
Shirayuki, Matsukase Asatsuyu, Hayakase Kikutsuki, Minatsuki Nagatsuki, Utsuki.. Isonami, Uranami.. Ayanami	Nagasaki .. Osaka .. .. Uraga .. .. Yokosuka ..	1906–10	220·3	20·6	6·0	2	374	6,000	29	6 12-prs.	2	70	90

Japan—*continued.*

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
DESTROYERS—*contd.*			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Kaifu, Umikaze, Yamakase	Maizuru ..	1909–11	310·0	..	9·0	..	1200	20,500	33	2 4·7-in., 5 3-in.	3	123	..
Sakura, Tashibana ..	Kure	1912	288·0	..	7·3	..	600	18,000	30	1 4·7-in. 4 12-pr.	4	..	..
Urakase	Yarrow ..	1915	275·3	27·6	7·11½	..	907	..	28	..	..	..	..
Amatsukase	Kure	1916	310·0	28·0	9·3	..	1227	..	34	..	..	..	..
Tokitsukaze	Kawasaki ..												
Isokaze	Kure												
Hamakaze	Nagasaki ..												
Kaba	Yokosuka ..	1915	260·0	24·0	7·9	..	665	..	30	..	..	..	..
Kaede	Maizuru ..												
Kashiwa	Nagasaki ..												
Katsura	Kure												
Kiri	Uraga												
Kusunoki	Kawasaki ..												
Matsu	—												
Sakaki	Sasebo												
Sugi	Osaka												
Ume	Kawasaki ..												
Momo, Yanagi ..	Sasebo	1916–17	275·0	25·0	7·9	..	835	..	31·5	..	..	..	..
Kashi, Hinoki ..	Maizuru ..												
Nara	Yokosuka ..	1917–18	275·0	25·0	7·9	..	835	..	31·5	..	..	..	..
Kuwa, Tsubaki ..	Kure												
Maki, Keyaki	Sasebo												
Yenoki	Maizuru ..												
Tanikase, Minekase	Maizuru ..	1916–19	320	29	9·5	..	1300	28,000	34	8 4·7-in., 2 M.	6	..	..
Kawakase	Yokosuka ..												
Sawakase	Mitsubishi ..												
Okikase, Shimakase, Nadakase, Yakase, Hakase, Momo, Kaya, Nore, Kure, Nashi, Taka, Kaki, Tsuga	Yokosuka ..												
FIRST CLASS—													
Hayabusa, Kasasagi, Manadzuru, Chidori	Normand ..	1898–99	147·7	16·0	4·0	2	150	4,200	29	1 6-pr., 2 3-prs.	3	26	30
Shirataka	Elbing ..	1899–1904	147·7	16·0	4·8	2	150	4,200	27	1 6-pr., 2 3-prs.	3	26	30
Aoataka, Hato, Hibari, Kari, Kiji, Tsubame	Kure												
Hashitaka, Kamone, Otori, Sagi, Uzuri	Kawasaki ..												
SUBMARINES—													
5 boats	Fore River, [U.S.A.	1904-5	65	12	..	..	120	..	9½–8	..	1	..	..
2 boats	Japan	1906	..	..	..	..	60·80	..	9·7	..	1	..	..
2 boats	Vickers ..	1908	135	13·5	..	..	325	..	14	..	2	..	..
4 boats	Kawasaki ..	1911–14	..	..	..	..	..	..	..	..	..	..	..

Additional destroyers are in hand—thirty-one second-class torpedo-boats, 1898–1901, 80 tons 27 knots.

In 1917 the construction of Laurenti type submarines, 1070 tons, 246 feet long, and able to travel 6000 miles, was begun at the yard of the Kawasaki company. A large number have been built.

Netherlands.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity
			Length.	Beam.	Draught.								
DESTROYERS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons
Wolf, Fret (1909) .. Bulhond, Jakhals (1910) Hermelijn, Lynx, Panter, Vos (1911)	Flushing ..	1910–1913	230	20·6	9	2	480	7,500	30	4 12-pr., 4 M.	2	84	80
FIRST CLASS—													
Minotaurus, Python	Flushing ..	1904	152·6	15·3	7·9	1	130	1,900	27	2 3-prs.	2	25	36
Zeeslang, Krokodil, Draak, Sfinx, Scylla	Flushing ..	1905	152·6	15·3	7·9	1	130	1,900	27	2 3-prs.	2	25	36
G 13–15–16	Scheldt .. Fijenoord ..	1914	165	17·3	9·5	..	188	2,000	26	2 12-pr.	3dbl	..	..
Z 1–4..	Amsterdam	1916–1917	201	20·4	6	2	322	5,500	27	2 12-pr., 2 M.	2 1dbl	39	53
Z 5–8..	Scheldt .. Fijenoord ..	1915	192	30	5, 6	2	310 322	5,500 5,700	27 27	2 12-pr., 2 M.	2 1dbl	39	81

The Yarrow destroyers have Yarrow water-tube boilers, and the later ones are fitted for the consumption of oil fuel. Submarine boats. Nos. 2 and 3, 132–150 tons, 11 8 knots, 2 tubes. Nos. 4 and 5,380 tons, 151 ft. 6 in. long, 16 knots (surface), 11 knots (submerged) speed. Nos. 6 and 7 built in Holland. British interned submarine bought by the Dutch Government and taken over as O 8. June 1917. K 1 for the East Indies, 320–390 tons, 105 ft. long, 10 ft. beam, 300 h.p. (Diesel), and 300 h.p. (electric), 16 knots (surface), 11 knots (submerged speed), 2 tubes, K 2 and K 3, of the same class, built for the Dutch Indies. Seven large submarines built at the Fijenoord dockyard and Scheldt (1918). Submarine mine-layer M 1 (*ex*-German).

Norway.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
DESTROYERS—			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Valkyrien	Elbing ..	1896	190	24·3	9·3	2	380	3,300	23·2	4 12-pdrs.	2	59	90
Draug, Troll, Garm	Horten ..	1908–13	226	25·0	..	2	540	7,500	27·0	6 12-pdrs.	3	71	95
FIRST CLASS—													
Snoegg, Stegg, Trygg	Horten ..	1919–1920	175	18	5½	2	220	3,500	25	2 12-pdr.	4	31	29
SECOND CLASS—													
Hval, Delfin	Elbing ..	1896–	130·0	15·0	6·9	1	84	1,100	24·5	2 1·4-in.Q.F.	2	19	17
Storm, Brand, Trods	Horten ..	1900	128·0	15·0	..	1	84	1,100	23	2 1·4-in.Q.F.	2	19	17
Laks, Sild, Sael, Skrei	Horten ..	1901	128·0	15·0	6·9	1	84	1,100	23	2 1·4-in.	2	19	17
Kjek, Hvas, Dristig Kvik, Djerv, Blink,	Fredrikstad	1898	111·5	14·5	6·3	1	65	650	19	2 1·4-in.	2	..	..
Lyn, Hauk, Falk ..	Horten ..	1903											
Skarv, Teist, Lom, Jo, Grib	Horten ..	1906–7	134·5	14·9	..	1	100	1,700	25·0	2 3-pr.	2–3	18	16
Ravn, Orn	Horten ..	1903	119	14·9	6·4	1	73	1,035	22·5	2 1·4-in.	2	16	15
Kjell	Horten ..	1912	135	14·9	6·4	1	100	1,800	25	1 12-pr.	3	19	16
SUBMARINES—													
A 1, 2, 3, 4	Germania Kiel	1909 to 1913	131·6	14·9	9·6	2	220 255	440 250	12 9	..	3	17	..
MINING VESSELS:—													
Froeya	Horten ..	1917–	250	27	8½	2	755	..	22	4 4-in.	2	80	96
Glommen, Laugen..	Christiania..	1918	138	28	6½	2	335	..	9·5	2 12-pdr.	..	39	21

Spain.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Destroyers—													
Terror, Audaz.. ..	Clydebank ..	1896	220	22	5·6	2	300	6,000	28	2 12-pr. 2 6-pr. 21-pr.	2	67	100
Osado, Proserpina ..	Clydebank ..	1897	225	25·6	5·8	2	400	7,500	30	2 14-pr. 2 6-pr. 21-pr.	2	70	90
Bustamente	Cartagena ..	1915	220	22	7·5	..	370	6,250*	28	5 6-pr.	2	..	..
Villamil	Cartagena ..												
Cadarso	Cartagena ..												
First Class—													
24 boats	Cartagena ..	1915 & Pro.	164	17·2	4·9	3	183	3,750*	26	3 3-pr.	3	..	..
Azor, Halcón	Poplar.. ..	1887	134·5	14	6	1	108	1,600	24	4 3-pr.	3	23	25

Azor and Halcón re-boilered by Yarrow (water-tube). * Parsons' turbines and Normand type boilers.

Six additional destroyers completing. In September, 1917, three submarines (A 1, 2 and 3), built in Italy, were delivered, and six others built and completing will give Spain a flotilla of ten boats, the tenth being the old Peral.

Sweden.

Name or Number.	Where Built.	Launched.	Dimensions.			Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament.	Torpedo Tubes.	Complement.	Fuel Capacity.
			Length.	Beam.	Draught.								
			Feet.	Feet.	Feet.		Tons.		Knots.				Tons.
Destroyers—													
Mode	Yarrow ..	1902	220·3	20·6	8·9	2	480	6,800	32·4	1 12-pr. 5 6-prs.	2	55	95
Magne	Thornycroft	1905	216·9	20·8	8·2	2	480	7,200	30·0	2 12-prs. 4 6-prs.	2 dbl.	63	90
Wale..	Malmo ..	1906											
Ragnar	Malmo ..	1909											
Sigurd	Gothenburg	1909											
Vidar	Malmo ..	1909											
Hugin	Gothenburg	1909											
Munin	Malmo ..	1910											
Wrangel	Gothenborg	1918	230	22	8·2	2	500	..	30·0	2 12-prs., 6 4-prs.	2 dbl.	..	..
Wachtmeister.. ..													
First Class—													
Blixt..	Carlskrona..	1898	128	15·9	6·11	1	92	1,260	23·5	2 1·9-in. Q.F.	2	18	17
Meteor	Carlskrona..	1899	128	15·9	6·11	1	92	1,330	23·8	2 1·9-in. Q.F.	2	18	17
Stjerna	Carlskrona..	1899	128	15·9	6·11	1	92	1,250	23·4	2 1·9-in. Q.F.	2	18	17
Orkan	Carlskrona..	1900	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q.F.	2	18	17
Vind	Carlskrona..	1900	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q.F.	2	18	17
Bris	Carlskrona..	1900	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q.F.	2	18	17
Virgo	Carlskrona..	1902	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q F.	2	18	17
Mira	Carlskrona..	1902	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q.F.	2	18	17
Orion	Carlskrona..	1903	128	15·9	6·11	1	92	1,250	23·5	2 1·5-in. Q.F.	2	18	17
Sirius													
Kapella													
Pleiad, Castor, Pollux	Normand ..	1909	125	15	6·6	1	96	1,900	26	2 1·5-in. Q.F.	2	18	20
Vega	Carlskrona..	1910	125	17·5	8·6	1	105	1,900	25	1 6-pr. 1 1·4-in.	2	18	20
Vesta													
Spica, Astrea, Iris, Thetis	Bergsund and Gothenburg	1910	125	17·5	8·6	1	105	1,900	25	1 6-pr. 1 1·4-in.	2	18	20
Altair	Stockholm ..	1908	128	17·5	8·6	..	110	2,000	25	2 6-prs.	2	18	20
Antares													
Argo													
Arcturus													
Perseus, Polaris ..	Bergsund ..	1910-1915	128	17·5	8·6	1	110	2,000	25	12 6-pr.	2	18	20
Regulus, Rigel ..	Stockholm ..												
A, B, C, D	Carlskrona & Gothenburg												
Submarines—													
Enroth	Stockholm ..	1902	82·0	13·0	11·6	2	146	100	12-11	..	1	..	..
Hajen	Stockholm ..	1903	65·0	11·6	..	..	120	200	10-7	..	..	..	..
No. 1..	Muggiano ..	1908	139·6	14·2	6·9	..	185-235	750	15-7½	..	2	15	..
Nos. 2, 3, 4	Stockholm ..	1911	136·6	14·2	6·9	..	185-535	750	15-7½	..	2	15	..
Svaerdfisken	Malmö . ..	..	..	..	..	..	250 370	..	..	..	2	..	..
Tumlaren . . .													

Also ten small torpedo-boats, 60 tons, built 1907–1908. Submarine Delfin completed by the Bergsund firm, Aborren, Laxen. and Gaeddan at Malmö, and two others at the latter place have been completed.

Details of the Swedish submarines are given under reserve. The above list is believed not to be correct in all particulars, but the facts are confidential.

United States

The Destroyers of the United States Navy in the subjoined list number 287, and 45 additional boats are in early stages of construction or projected. The following are the earlier boats which have a maximum speed of 30 knots:—

Paulding, Drayton, Roe, Terry, Perkins, Sterett, McCall, Burrows, Warrington, Mayrant, Monaghan, Tripple, Walke, Ammen, Patterson, Fanning, Jarvis, Henley, Beale, Jouett, Jenkin (21 boats).

These boats are 289 ft. long, with 26-ft. beam, 8-ft. 4-in. draught, 742 to 900 tons displacement, 11,000 to 12,000 H.P., speed 20 to 30 knots, five 3-in. guns, three 18-in. twin torpedo-tubes, fuel 210 tons, complement 89; built 1910–11.

The destroyers in the succeeding lists date from 1913 onward, and mark the approach to better sea-keeping qualities, and the introduction of a bigger gun and more powerful torpedo armament. Their displacements rise from 1020 to 1215 tons, their engine-power from 15,300 to 27,000, and their speed from 30 to 35 knots.

The first named of the 35-knot boats is the **Ringgold**. All these destroyers mount four 4-in. guns, and the later boats have each two 1-pr. A.A. guns.

With the **Hart** the calibre of these last guns is increased to 3 in., but the latest boats, from the **Clemson** onward, carry only one A.A. gun.

With regard to torpedo armament the first eight boats in the following list, **Cassin** to **Balch**, have each three 18-in. twin tubes, but in all the others the diameter is increased to 21 in., and in the boats built from the **Sampson** onward, that is, after the fortieth boat, a system of triple tubes has been installed. All these boats are from 300 ft. to 310 ft. long, with beam of 30 ft. 4 in. to 31 ft., and mean draught of about 9 ft. 4 in. They have a maximum fuel capacity of 300 tons, and complement of 98. The series is as follows:—

Cassin, Cummings, Downes, Duncan, Aylwin, Parker, Benham, Balch, O'Brien, Nicholson, Winslow, McDougal, Cushing, Ericsson, Tucker, Conyngham, Porter, Wadsworth, Wainwright, Sampson, Rowan, Davis, Allen, Wilkes, Shaw, Caldwell, Craven, Gwin, Conner, Stockton, Manley, Wickes, Philips, Woolsey, Evans, Little, Kinberley, Sigourney, Gregory, Stringham, Dyer, Colhoun, Stevens, McKee, Robinson (45 boats), 1916–18.

Ringgold, McKean, Harding, Gridley, Fairfax, Taylor, Bell, Stribing, Murray, Israel, Luce, Maury, Lansdale, Mahan, Schley, Champlin, Mugford, Chew, Hazelwood, Williams, Crane (21 boats), 1918–19.

Hart, Ingraham, Ludlow, Rathburne, Talbot, Waters, Dent, Dorsey, Lea, Lamberton, Radford, Montgomery, Breese, Gamble, Ramsay, Tattnall, Badger, Twiggs, Babbitt, De Long, Jacob Jones, Buchanan, Aaron Ward, Hale, Crowninshield, Tillman, Boggs, Kilty, Kennison, Ward, Claxton, Hamilton, Tarbell, Yarnall, Upshup, Greer, Elliot, Roper, Breckinridge, Barney, Blakeley, Biddle, Du Pont, Bernadou, Ellis, Cole, J. Fred Talbott, Dickerson, Leary, Schenck, Herbert, Palmer, Thatcher, Walker, Crosby, Meredith, Bush, Cowell, Maddox, Foote, Kalk, Burns, Anthony, Sproston, Rizal, Mackenzie, Renshaw, O'Bannon, Hogan, Howard, Stansbury, Hopewell, Thomas, Haraden, Abbot, Bagley (76 boats), 1919–20.

The following are all new 35-knot boats, many of them still uncompleted: Clemson, Dahlgren, Goldsborough, Semmes, Satterlee, Mason, Graham, Abel P. Upshur, Hunt, Welborn C. Wood, George E. Badger, Branch, Herndon, Dallas, Chandler, Southard, Hovey, Long, Broome, Alden, Smith Thompson, Barker, Tracy, Borie, John D. Edwards, Whipple, Parrott, Steward, Hatfield, Brooks, Gilmer, Fox, Cane, Humphreys, McFarland, James K. Paulding, Overton, Sturtevant, Childs, King, Sands, Williams, Reuben James, Belknap, McCook, McCalla, Rodgers, Ingram, Bancroft, Welles, Aulick, Turner, Gillis, Delphy, McDermut, Daub, McBanahan, Edwards, Greene, Ballard, Shubrick, Bailey, Thornton, Morris, Tingey, Swasey, Meade, Sinclair, McCawley, Moody, Henshaw, Meyer, Doyen, Sharkey, Toucey, Breck, Isherwood, Case, Lardner, Putnam, Worden, Flusser, Dale, Reid, Chauncey, Fuller, Percival, John Francis Burnes, Farragut, Somers, Stoddert, Reno, Farquhar, Thompson, Kennedy, Paul Hamilton, William Jones, Woodbury, S. P. Lee, Nicholas, Young, Zeilin, Yarborough, La Vallette, Sloat, Wood, Shirk, Kidder, Selfridge, Marcus, Mervin, Chase, Robert Smith, Mullany, Preston, Lamson, Litchfield, Zane, Wasmuth, Trever, Hulbert, Noa, William B. Preston, Preble (124 boats).

In addition are seventeen coast torpedo-boat, 165–280 tons, dating from 1897–1902.

SUBMARINES.

The submarine flotillas are as follows:—

AA 1, 2, 3.	New boats probably not yet completed		3
A 2 to 7.	1901–2.	120 tons, 8–7 knots	6
B 1, 2, 3.	1909	170 tons, 10–8½ knots	3
C 1 to 5.	1906–9.	273 tons, 10·8 knots	5
D 1, 2, 3.	1909.	278-340 tons	3
		(All the above are suitable only for harbour defence.)	
E 1, 2.	1913–14.	662–867 tons, 15–10 knots	2
F 2, 3.	1914–15.	325-400 tons, 14·9½ knots	2
G 1, 3, 4.	1914–15.	695-965 tons, 15½–9½ knots	3
H 1 to 9.	1914–15.	440–515 tons, 12–10½ knots	9
K 1 to 8.	1916.	1880-2650 tons, 24·9½ knots	8
L 1 to 11.	1916–17.	890-1080 tons, 17½ 10½ knots	11
M 1.	1918.	740 tons, 14–11 knots	1
N 1 to 7.	1918–19		7
O 1 to 16.	1918–19		16
R 1 to 27.	1918–19.	420–550 tons, 15–9½ knots	27
S 1 to 51.	All these are new boats, many of them probably not yet laid down, and few of them have been completed		51
Fleet submarines.	(Money not yet provided.)		9

The list makes a total of 166 boats, but probably not many more than 100 have been completed.

PLANS

OF

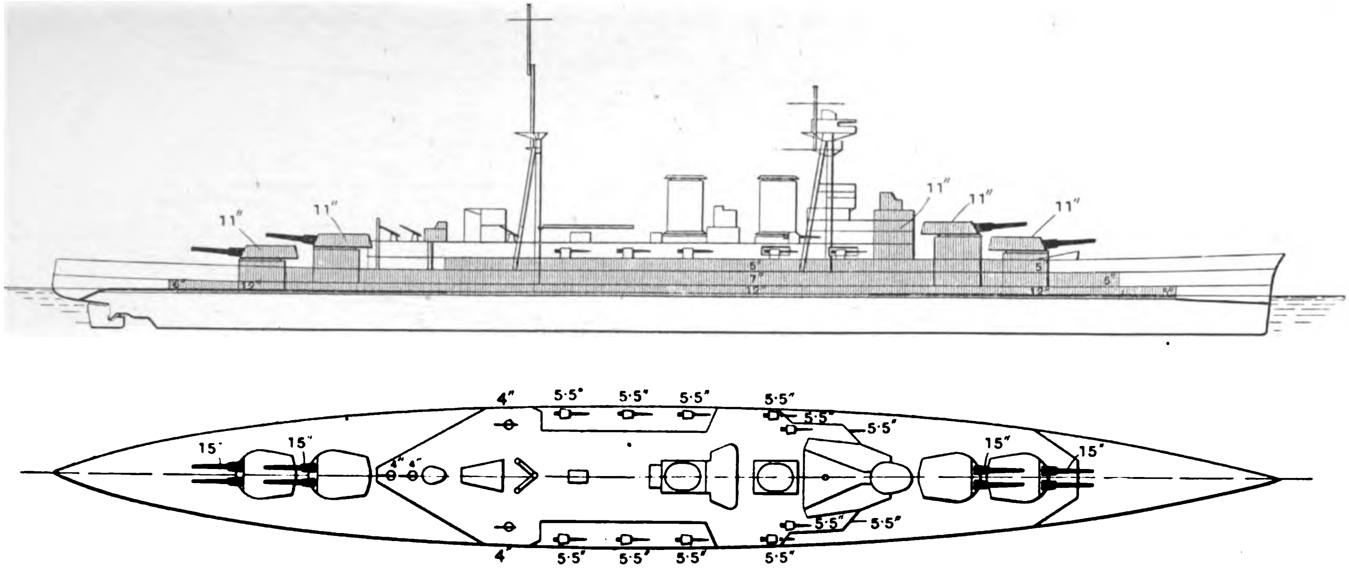
BRITISH AND FOREIGN SHIPS.

b

GREAT BRITAIN.

BATTLESHIP.

Hood.



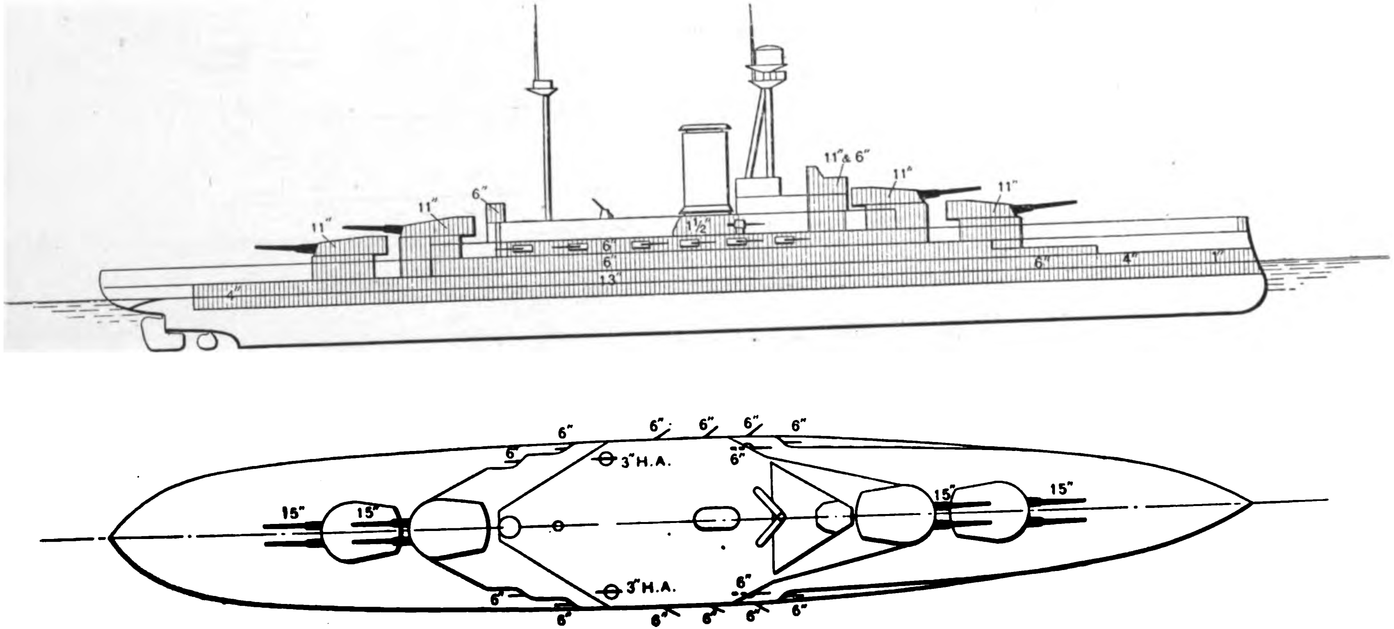
Length, 810 ft. ; 41,200 tons ; Speed, 31 knots ; Completed, 1918-20 ;
Armament, 8—15 in., 12—5·5 in., 4—4 in., A.A.

PLATE 1.

GREAT BRITAIN.

BATTLESHIPS.

Royal Sovereign. **Royal Oak.** **Revenge.** **Resolution.** **Ramillies.**

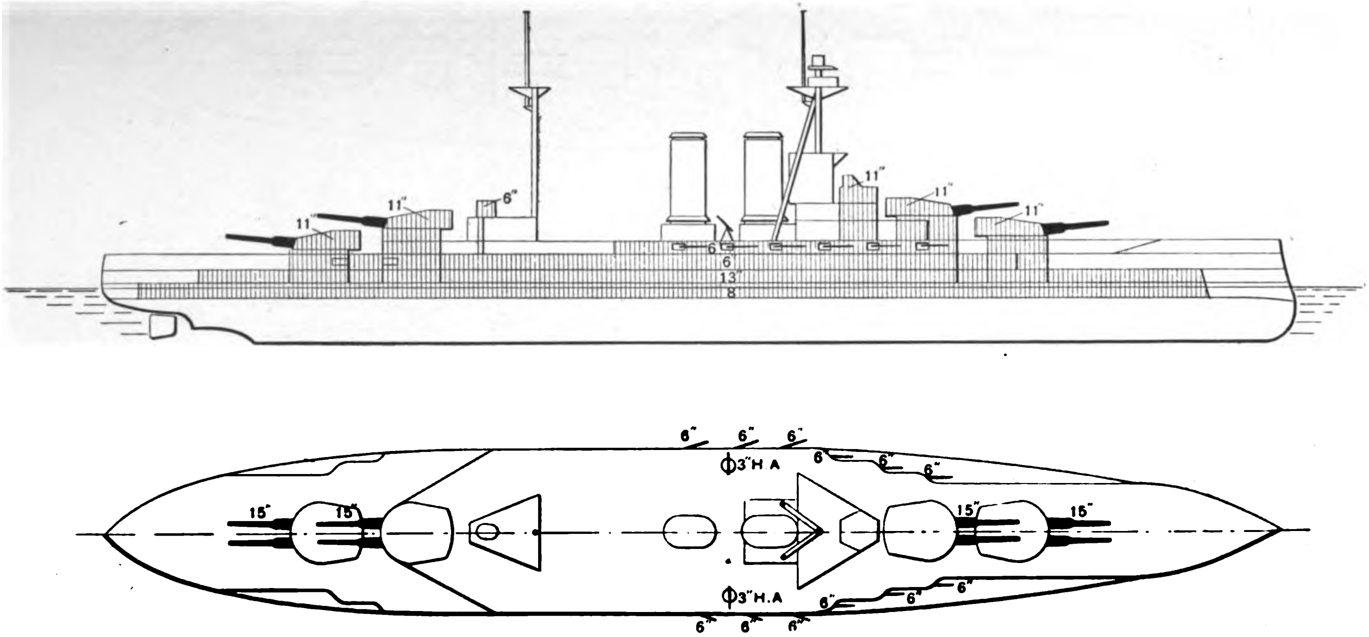


Length, 580 ft. ; 25,750 tons ; 23 knots ; Completed, 1916–7 ;
Armament, 8—15 in., 14—6 in., 2—3 in. H.A.

GREAT BRITAIN.

BATTLESHIPS.

Queen Elizabeth. Warspite. Barham. Valiant. Malaya.

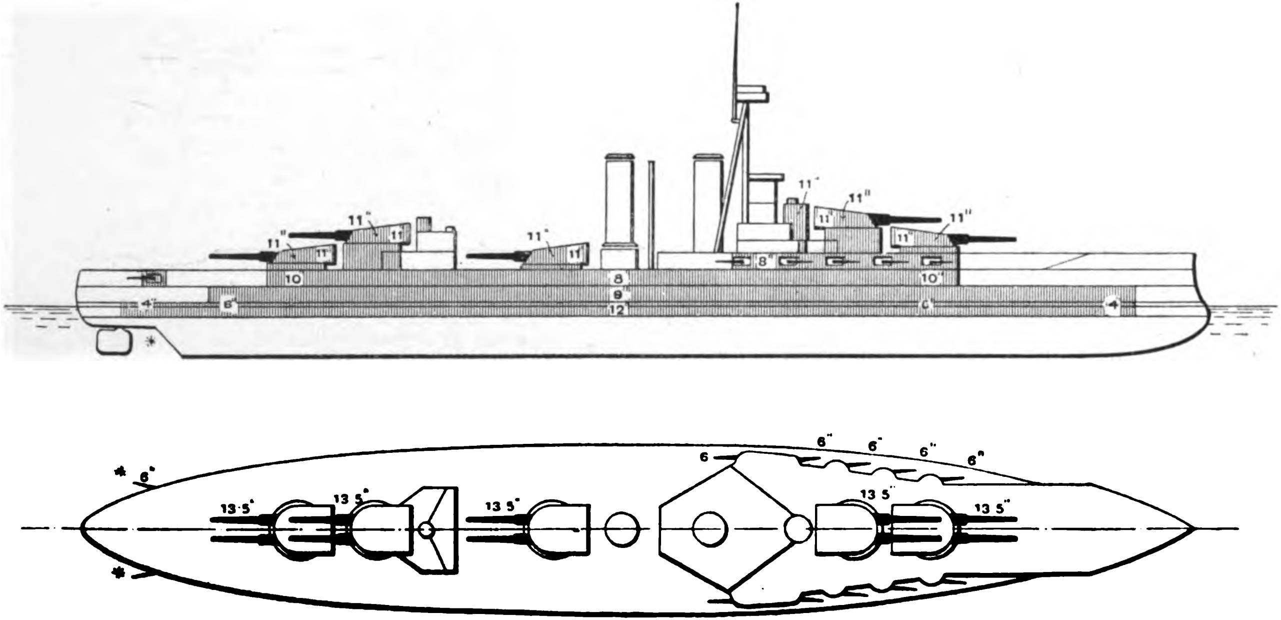


Length, 600 ft. ; 27,500 tons ; Speed, 25 knots ; Completed, 1915–1916 ;
Armament, 8—15 in., 12—6 in., 2—3 in. H.A.

GREAT BRITAIN.

BATTLESHIPS.

Iron Duke. **Marlborough.** **Benbow.** **Emperor of India.**



Length, 580 ft. ; 25,000 tons ; Speed, 21-22 knots ;
Armament, 10—13·5 in., 12—6 in., 2—3 in., 4—3 pr.

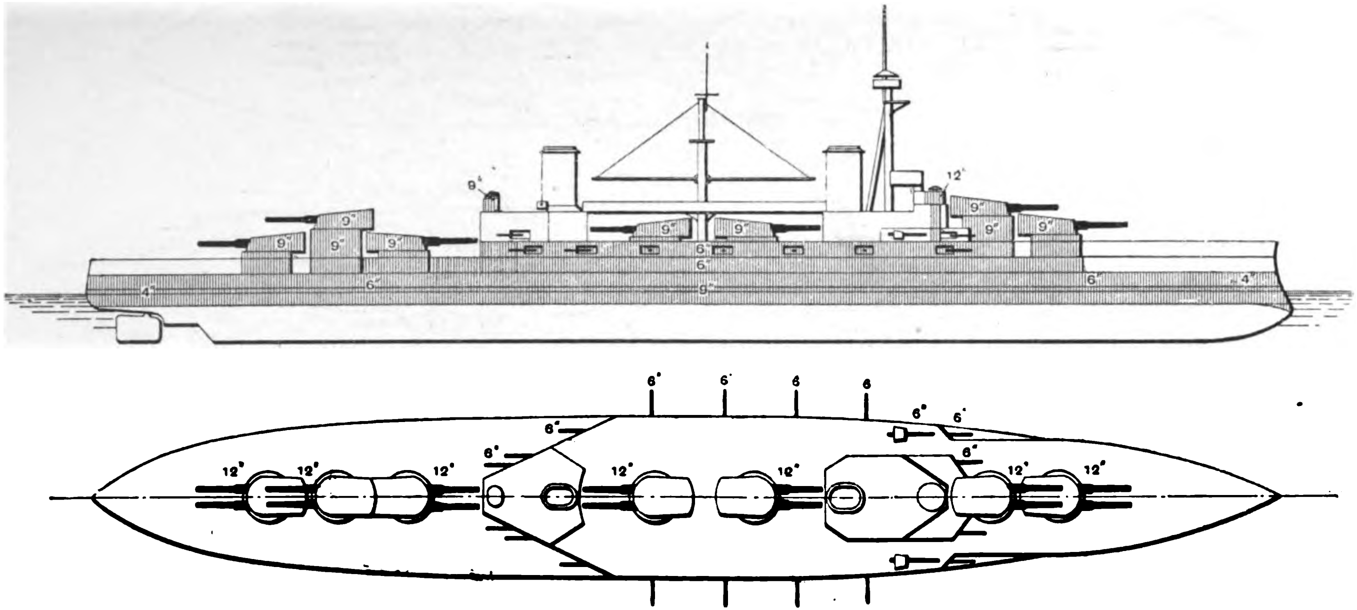
* These two guns have been removed to a position on forecastle abreast foremost funnel.

GREAT BRITAIN.

BATTLESHIP.

A Incourt (*Ex* Osman I.).

[*This vessel is now regarded as ineffective.*]



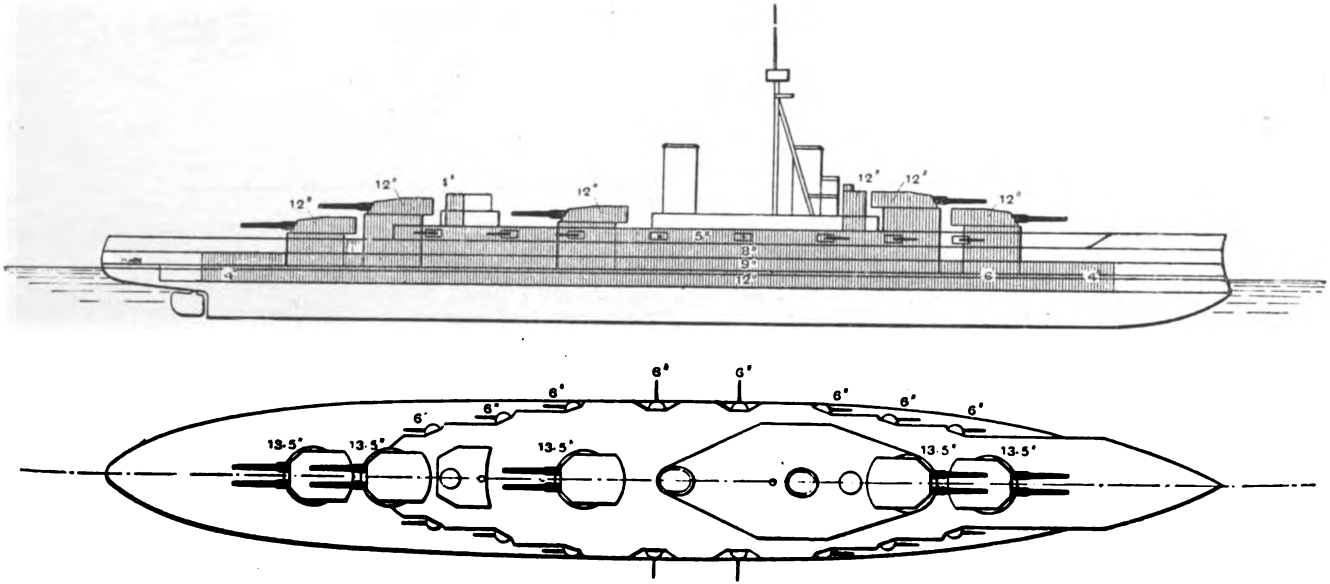
Length, 632 ft. ; 27,500 tons ; Speed, 22 knots ;
Armament, 14—12 in., 20—6 in., 10—12 pr.

PLATE 5.

GREAT BRITAIN.

BATTLESHIP.

Erin (*Ex* Reshadieh).

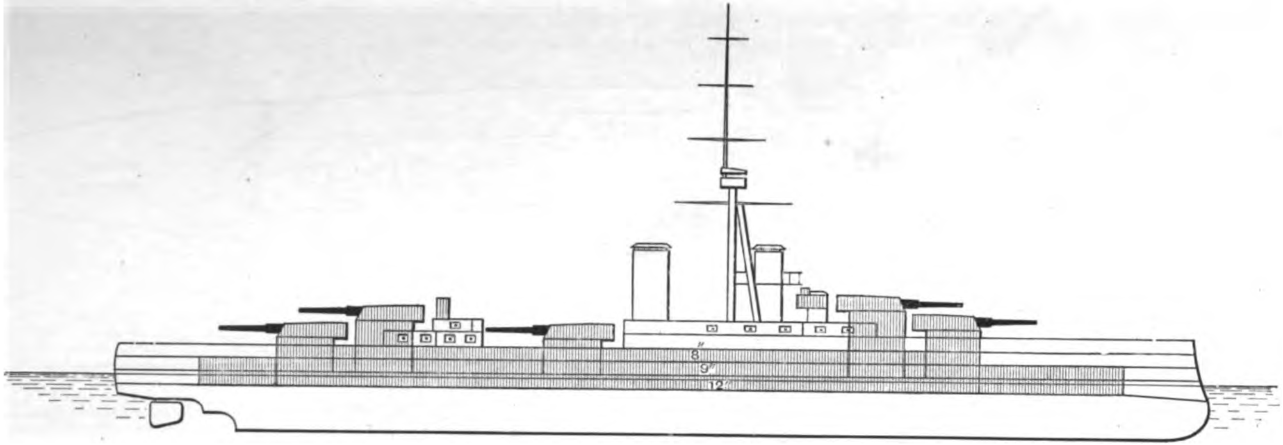


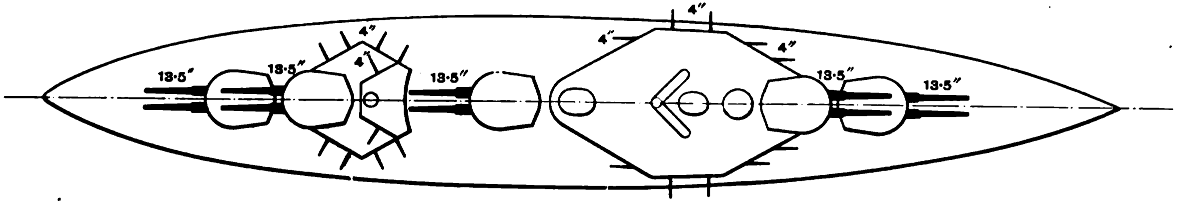
Length, 525 ft. ; 23,000 tons ; Speed, 21 knots
Armament, 10—13·5 in., 16—6 in.

GREAT BRITAIN.

BATTLESHIPS.

Orion. **Conqueror.** **Monarch.** **Thunderer.** **Ajax.** **Centurion.** **King George V.**





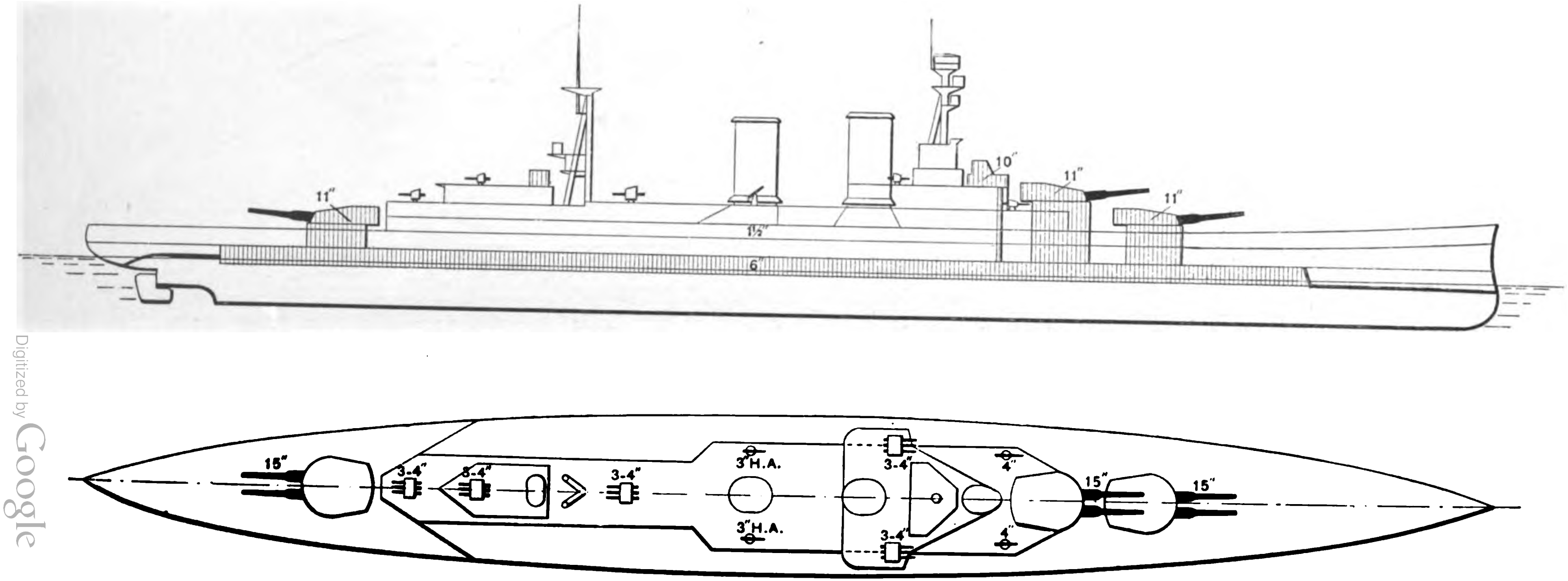
Orion . . . . }
Conqueror . . } Length, 545 ft. ; 22,500 tons ; Speed, 21-22 knots ; Armament, 10—13·5 in., 16—4 in., 4—3 pr., 5 small ; Completed, 1911-12.
Monarch . . . }
Thunderer . . }
Ajax . . . . }
Centurion . . } Length, 555 ft. ; 23,000 tons ; Speed, 22 knots ; Armament, 10—13·5 in., 16—4 in., 4—3 pr. ; Completed, 1912-13.
King George V. }

PLATE 7.

GREAT BRITAIN.

BATTLE-CRUISERS.

Repulse. **Renown.**



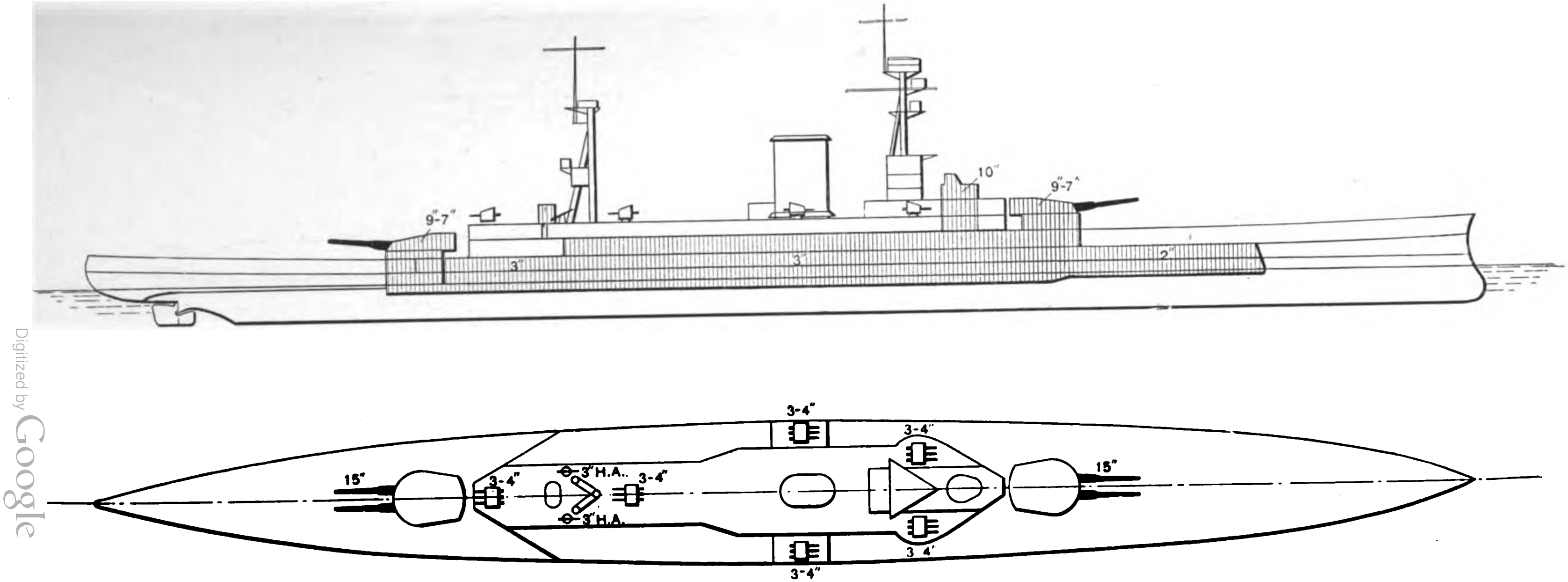
Length, 750 ft.; 26,500 tons; Speed, 32 knots; Completed, 1916;
Armament, 6—15 in., 17—4 in., 2—3 in. H.A.

PLATE 8.

GREAT BRITAIN.

LARGE LIGHT CRUISERS.

Courageous. **Glorious.**



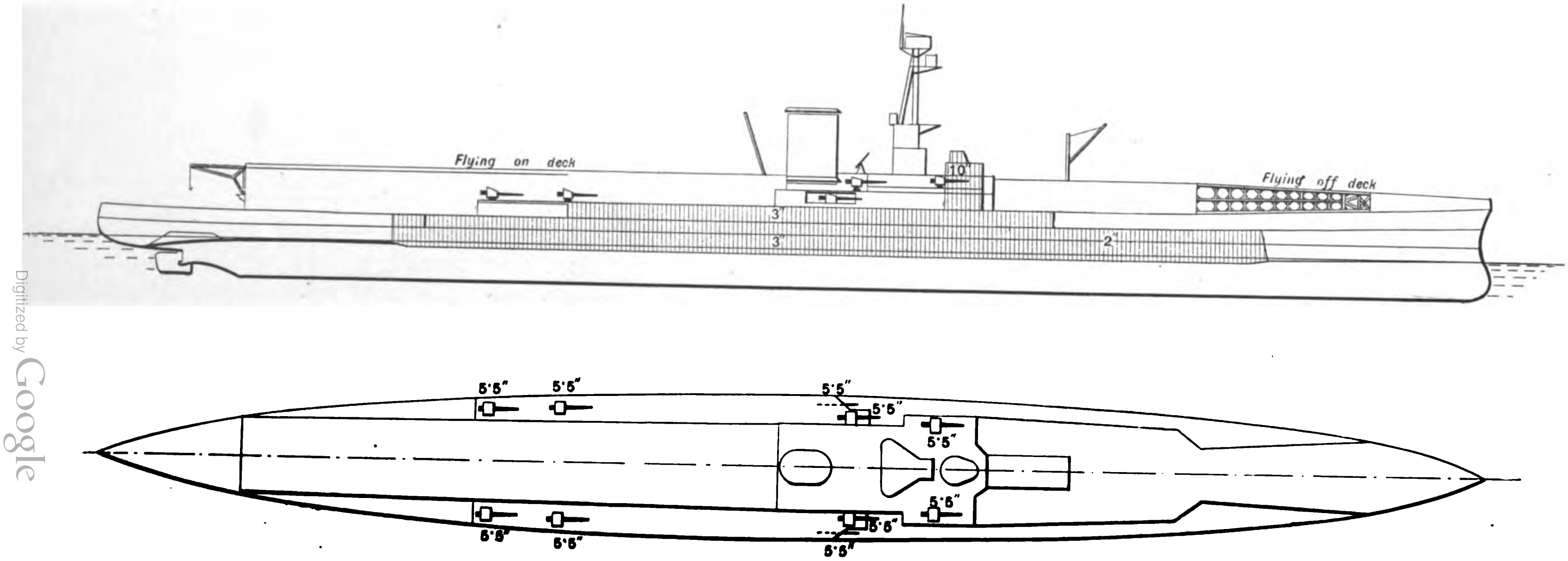
Length, 735 ft.; 18,600 tons; Speed, 32 knots; Completed, 1916;
Armament, 4—15 in., 18—4 in., 2—3 in. H.A.

Plate 9.

GREAT BRITAIN.

LARGE LIGHT CRUISER.

Furious.
(Seaplane Carrier.)

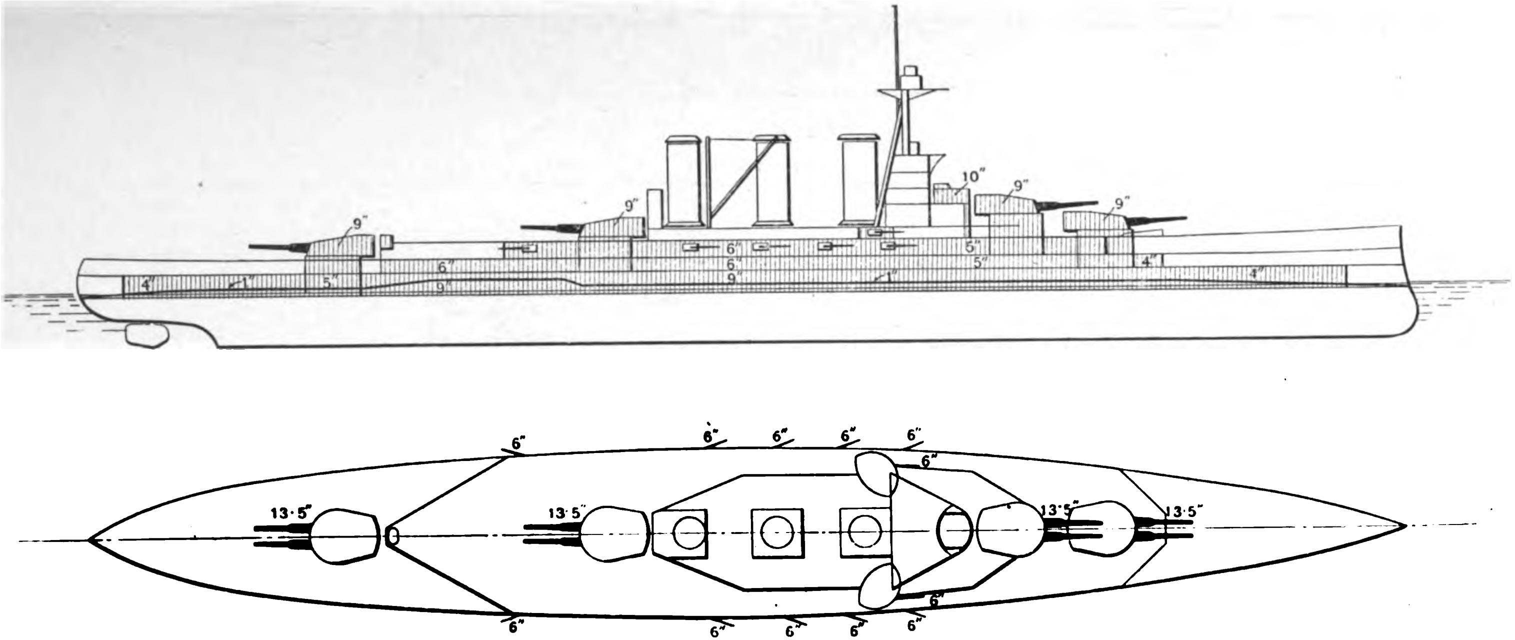


Length, 735 ft.; 19,500 tons; Speed, 31½ knots; Completed, 1917;
Armament, 10—5·5 in.

GREAT BRITAIN.

BATTLE-CRUISER.

Tiger.

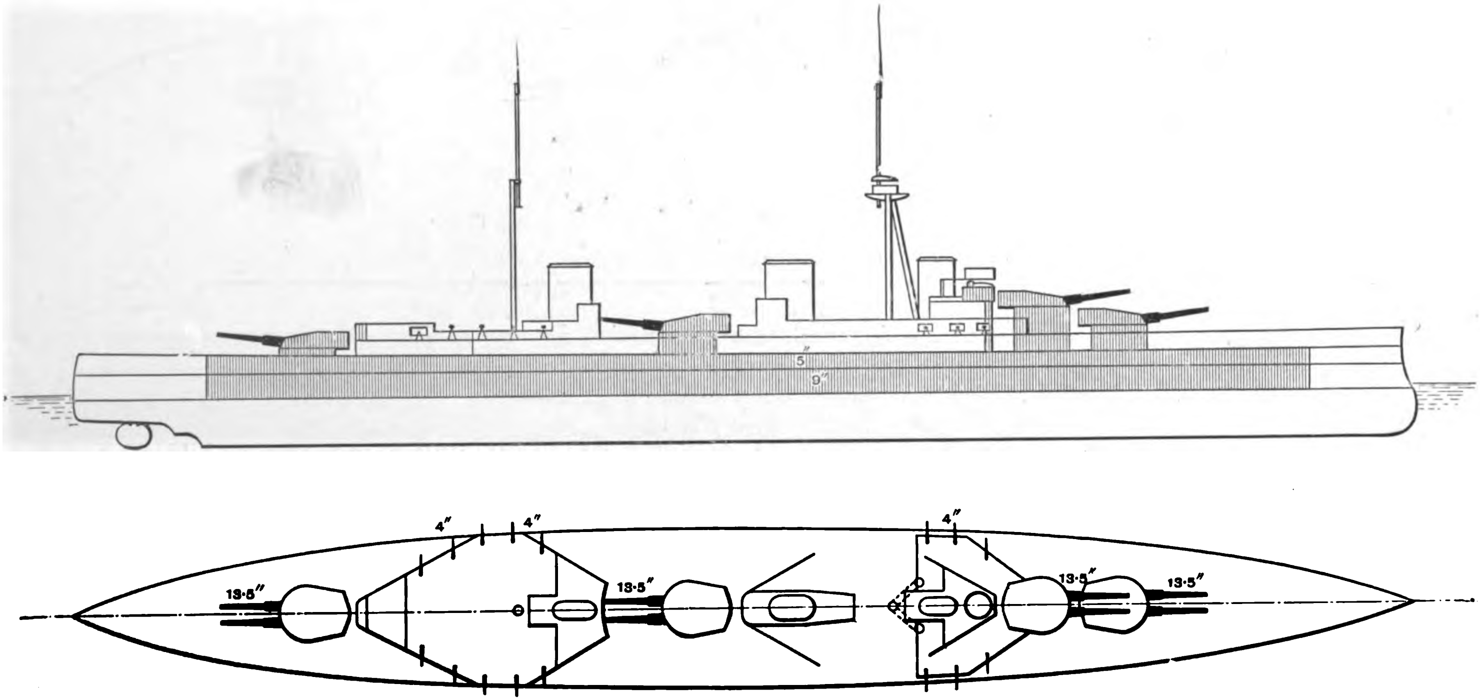


Length, 660 ft. ; 28,500 tons ; 30 knots ; Completed, 1914 ; Armament, 8—13·5 in. ; 12—6 in.

GREAT BRITAIN.

BATTLE CRUISERS.

Lion. **Princess Royal.**



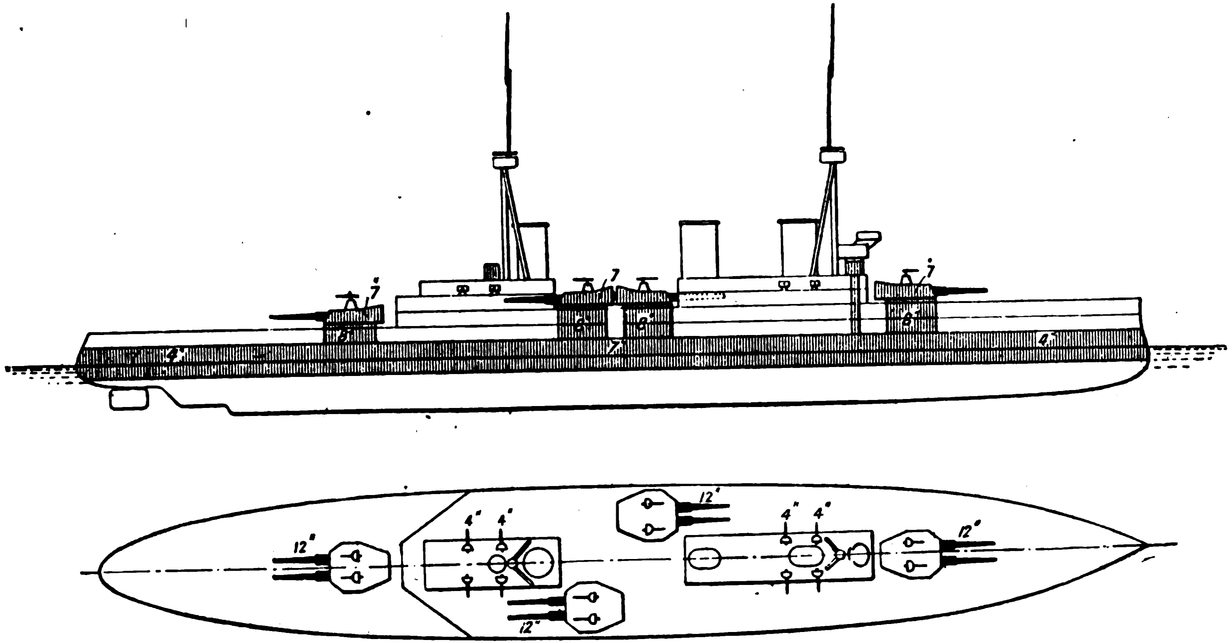
Length, 660 ft.; 26,350 tons; Speed, 28–28·5 knots; Completed, 1912–13;
Armament, 8—13·5 in., 16—4 in., 4—3 pr., 4 small.

GREAT BRITAIN.

BATTLE CRUISERS.

Indomitable. **Inflexible.** **New Zealand.*** **Australia.***

[All capital ships with 12-in. guns are now regarded as ineffective.]



Indomitable } Length, 530 ft.; 17,250 tons; Speed, 26 knots; Completed, 1908-9; Armament, 8—12 in., 16—4 in., 5 small.
Inflexible

New Zealand } Length, 555 ft.; 18,800 tons; Speed, 25 knots; Completed, 1911-13; Armament, 8—12 in., 16—4 in., 4—3 pr., 5 small.
Australia

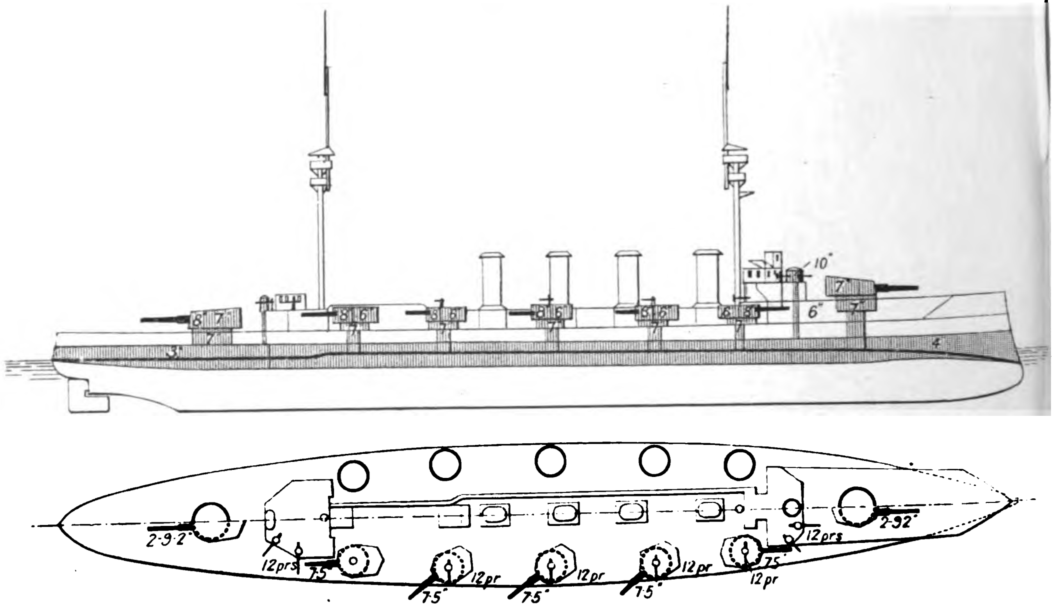
* The centre turrets are more *en échelon* than in the two earlier ships.

GREAT BRITAIN.

ARMOURED CRUISERS.

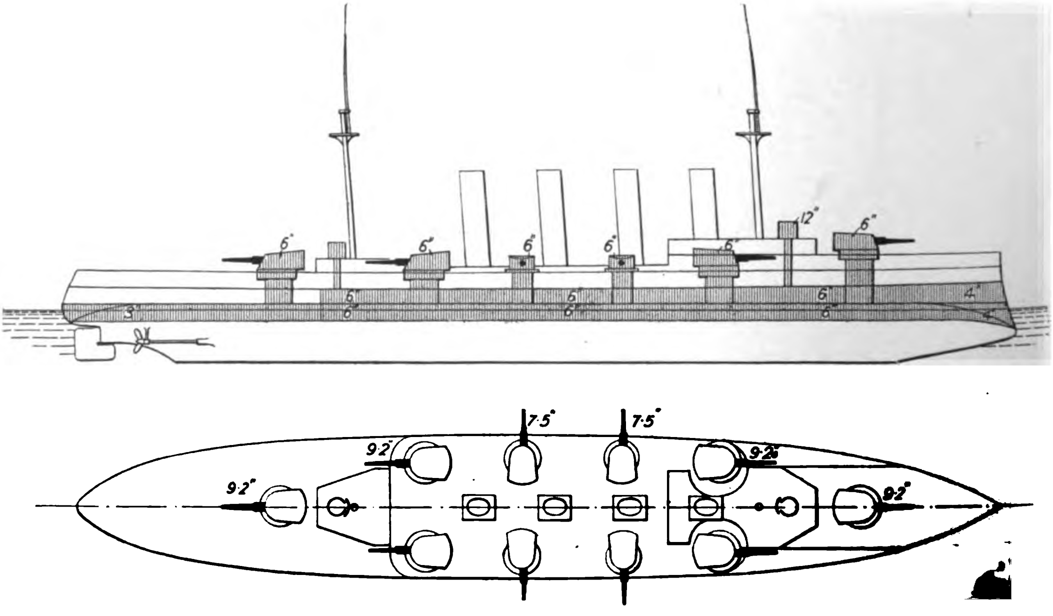
Minotaur. **Shannon.**

[*These vessels are now ineffective.*]



Length, 490 ft.; 14,600 tons; Speed, 22·5–23·5 knots; Completed, 1908–1909;
Armament, 4—9·2 in., 10—7·5 in., 16—12 pr., 5 small.

Achilles. **Cochrane.**

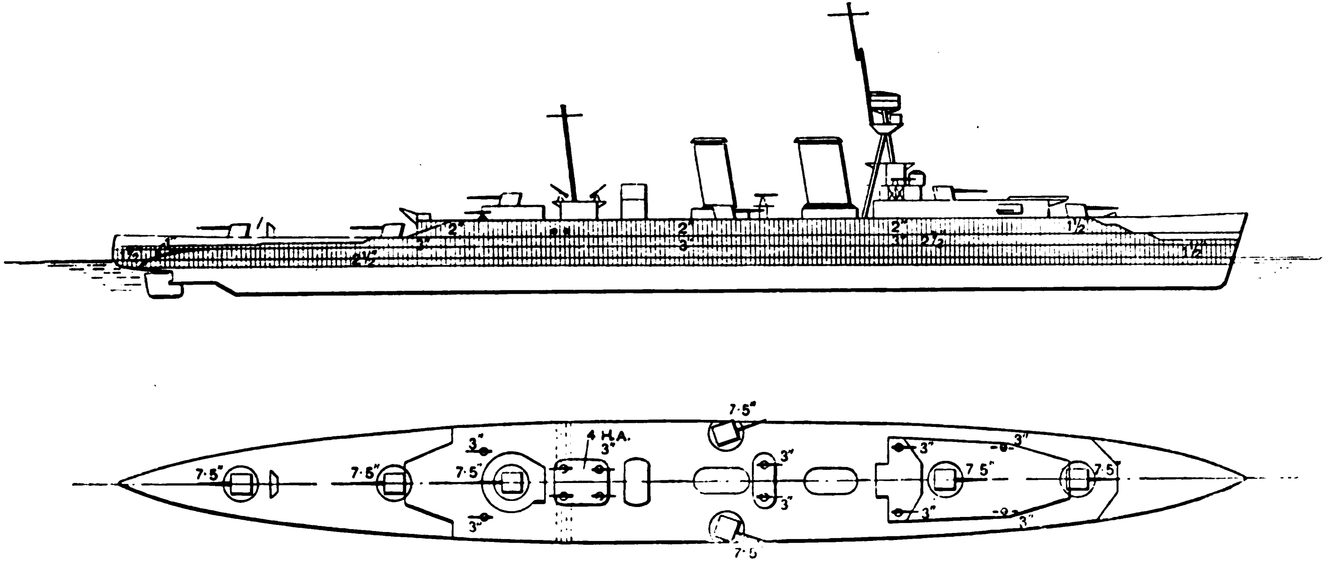


Length, 480 ft.; 13,550 tons; Speed, 22·3–23·3 knots; Completed, 1906–1907;
Armament, 6—9·2 in., 4—7·5 in., 24—3 pr., 2 small.

GREAT BRITAIN.

LIGHT CRUISERS.

Raleigh. **Effingham.** **Hawkins.** **Frobisher.**



Length, 565 ft. ; 9750 tons ; Speed, 30 knots ;
Armament, 7—7·5 in., 12—3 in.

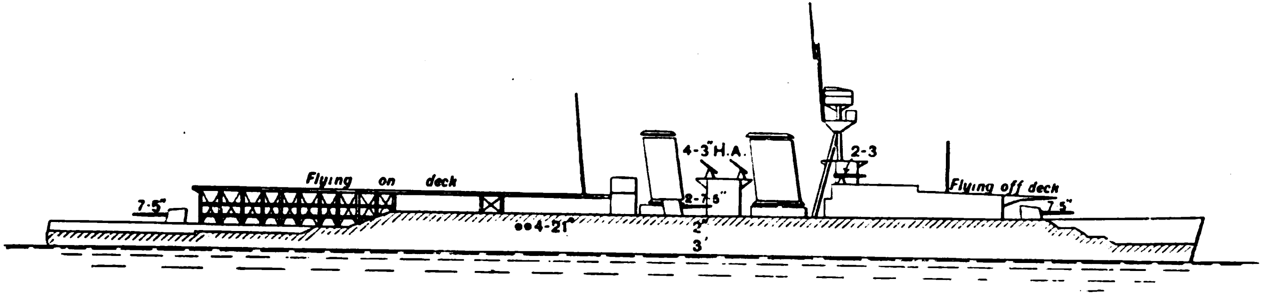
PLATE 15.

GREAT BRITAIN.

LIGHT CRUISER.

Vindictive.

Airplane Carrier.



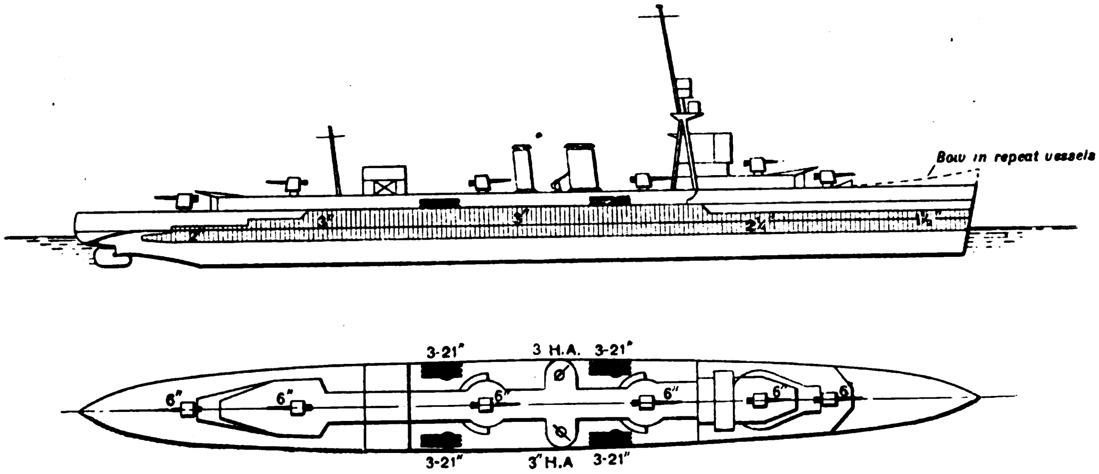
Length, 565 ft. ; 0750 tons ; Speed, 30 knots ; Completed, 1918 ;
Armament, 4—7·5 in., 6—3 in.

PLATE 16.

GREAT BRITAIN.

LIGHT CRUISERS. D CLASS.

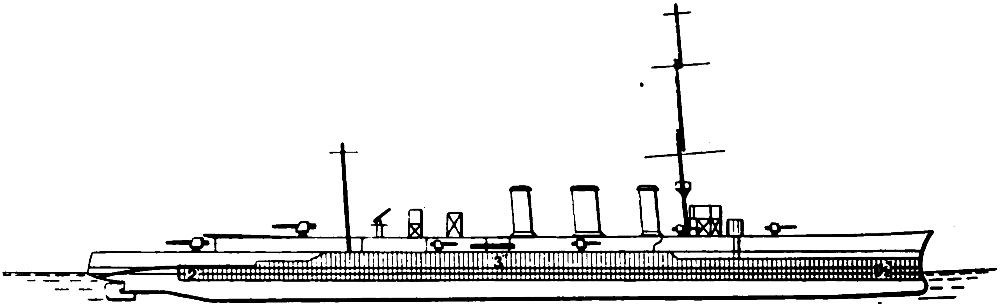
Despatch. **Diomede.** **Danae.** **Dauntless.** **Dragon.** **Delhi.** **Dunedin.** **Durban.**

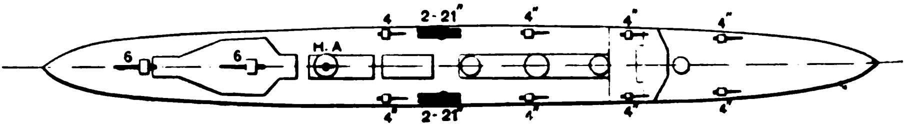


Length, 445 ft.; 4650 tons; Speed, 29 knots;
Armament, 6—6 in., 2—3-in. H.A.

GREAT BRITAIN.

LIGHT CRUISERS C CLASS (as originally built).



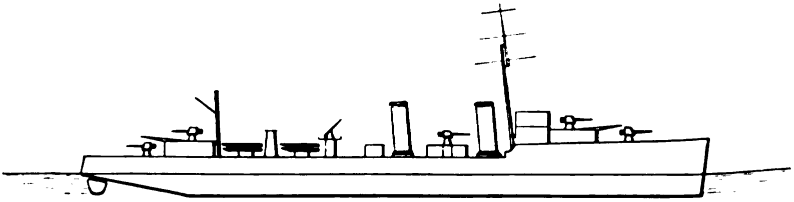


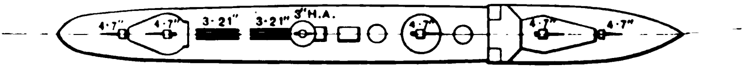
Length, 420 ft.; 3750 tons; Speed, 29 knots;
Armament, 2—6 in.; 8—4-in.; 1 H.A.

Calliope **Conquest** **Cordelia** **Carysfort** **Cleopatra** **Comus** **Caroline**	3 funnels	Conning tower and foremast removed since completion and tripod foremast added. 6-in. gun added on centre-line forward in lieu of 2—4-in. 6-in. gun added on centre-line amidships in lieu of 4—4-in. guns at waist.
Champion **Cambrian** **Canterbury** **Castor** **Constance**	2 funnels	
Centaur **Concord** **Caledon** **Calypso** **Caradoc**	2 funnels	5—6-in. guns, all on centre-line, 2—3-in. H.A.
Ceres **Curacoa** **Curlew** **Cardiff** **Coventry** **Cairo** **Capetown** **Carlisle** **Colombo** **Calcutta**	2 funnels	5—6-in. guns on centre-line, arranged as in D class, *i.e.*, end guns superimposed, 2—3-in. H.A.

NOTE.—Some C class cruisers have submerged tubes only and no above-water tubes.

FLOTILLA LEADERS: SCOTT CLASS.



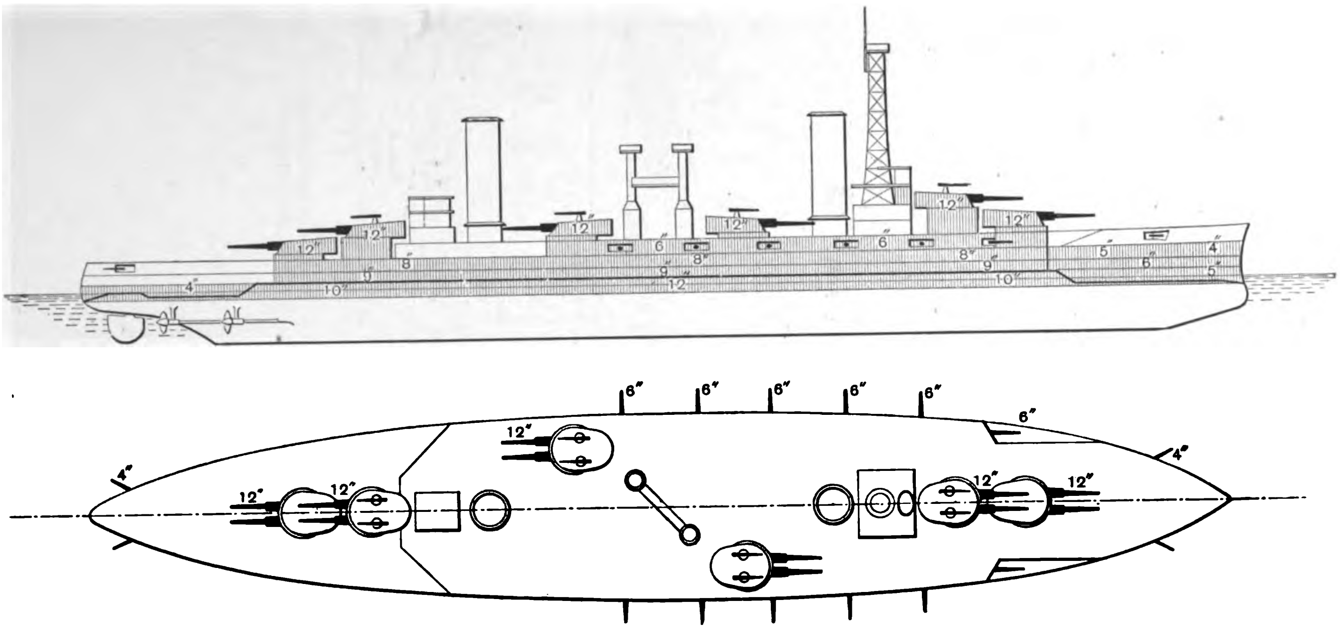


Length, 320 ft.; 1800 tons; Speed, 36 knots;
Armament, 5—4·7 in.; 1—3-in. A.A

ARGENTINE.

BATTLESHIPS.

Moreno. **Rivadavia.**

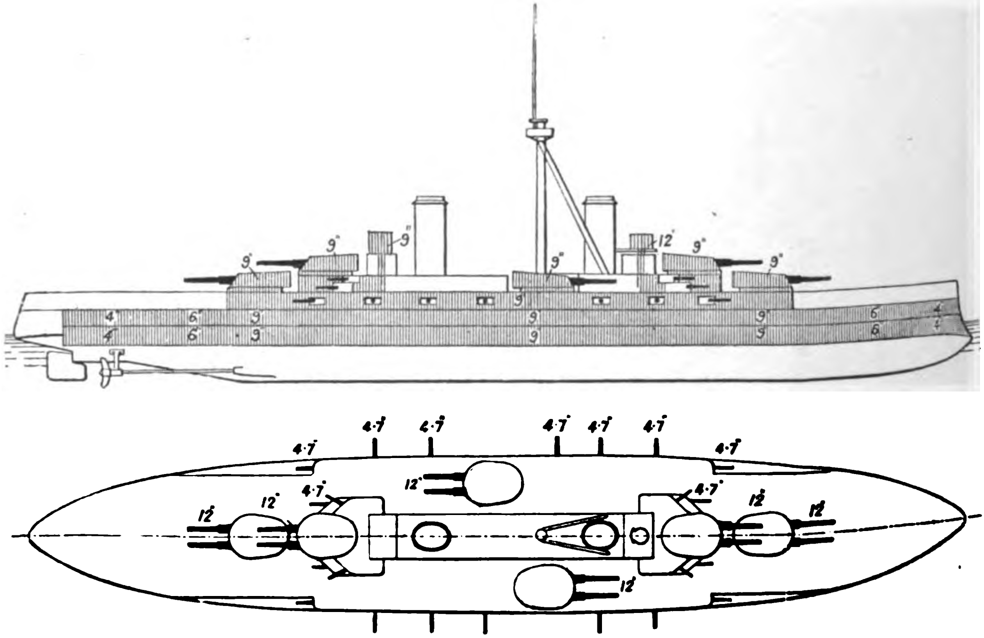


Length, 585 ft. ; 27,600 tons ; Speed, 22·5 knots ; Completed, 1914 ;
Armament, 12—12 in., 12—6 in., 16—4 in., 10 small.

BRAZIL.

BATTLESHIPS.

Minas Geraes. **Sao Paulo.**

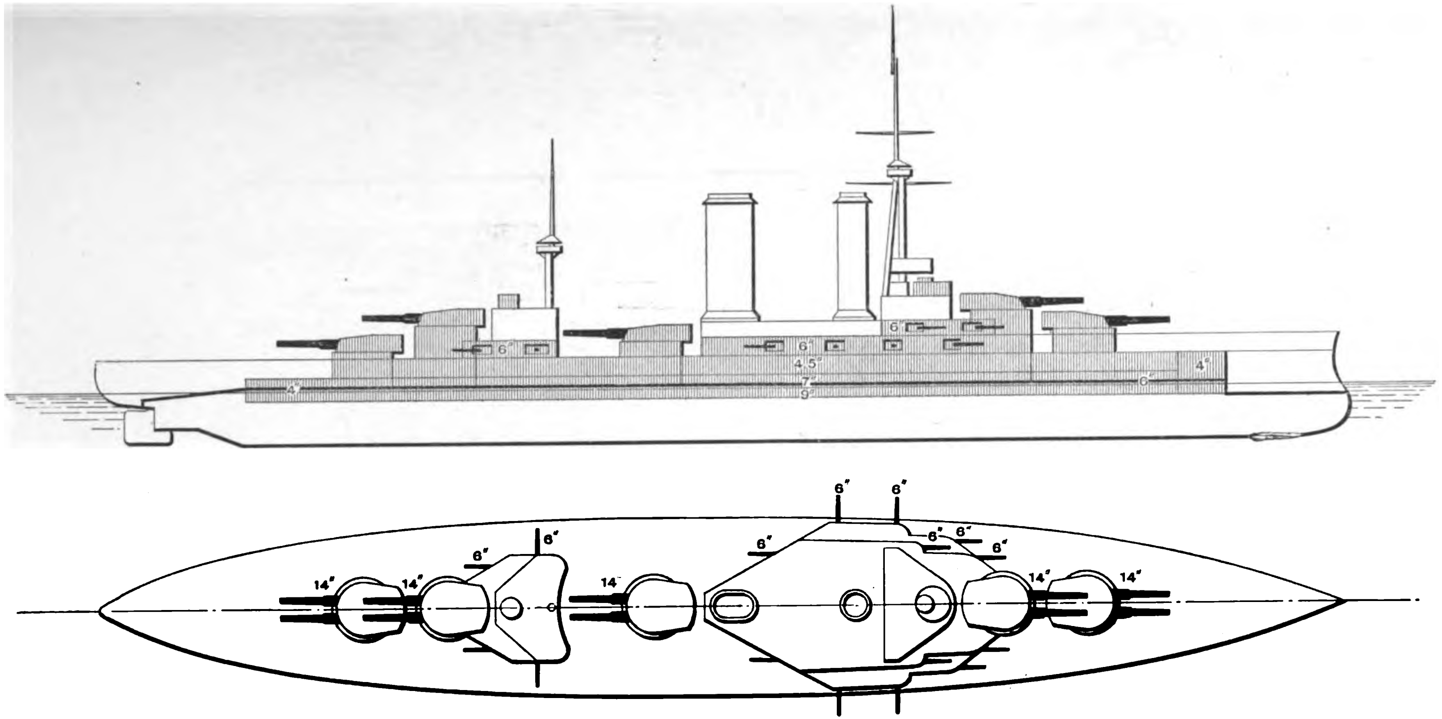


Length, 500 ft. ; 19,281 tons ; Speed, 21 knots ; Completed, 1909, 1910 ;
Armament, 12—12 in., 22—4·7 in., 8 small.

CHILE.

BATTLESHIP.

Almirante Latorre (*formerly* H.M.S. Canada).

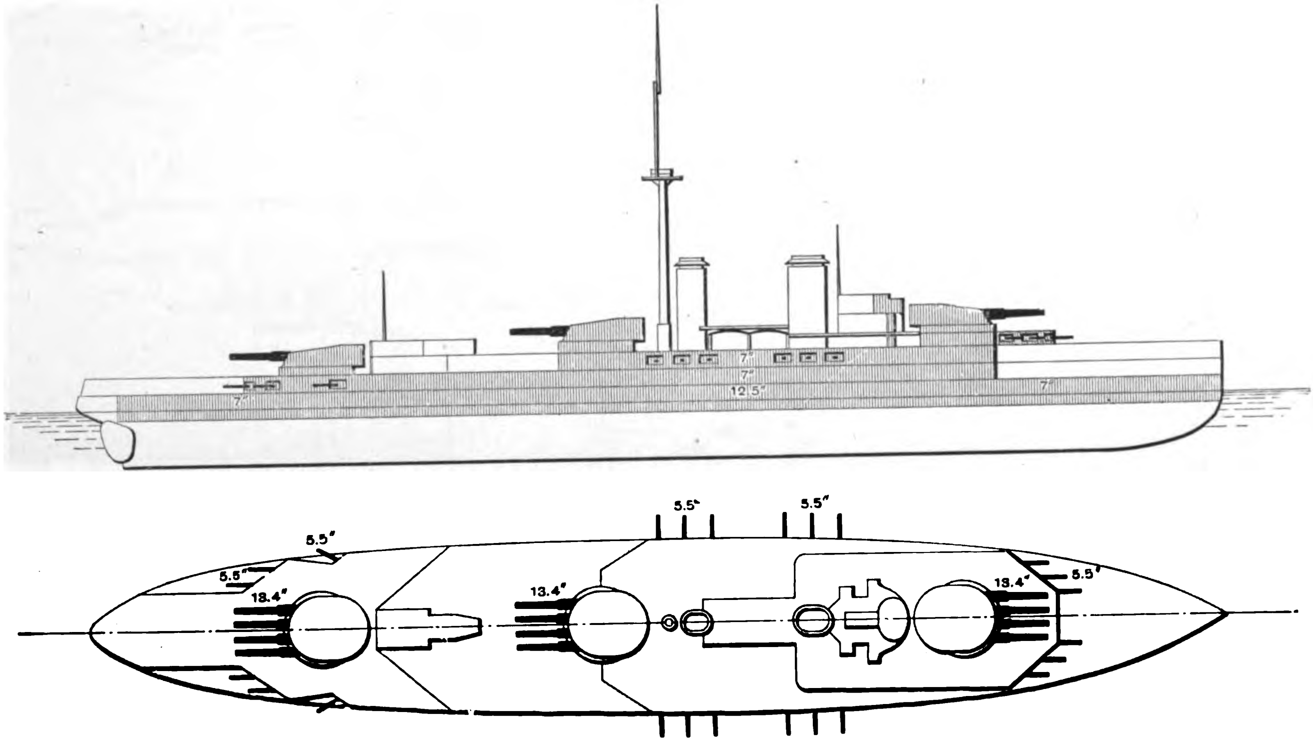


Length, 625 ft. ; 28,000 tons ; Speed, 23 knots ;
Armament, 10—14 in. ; 16—6 in. ; 4—3 in., and smaller.

BATTLESHIPS.

Normandie. **Flandre.** **Gascogne.** **Languedoc.** **Béarn.**

[*These vessels, which were begun before the war, will not be completed.*]

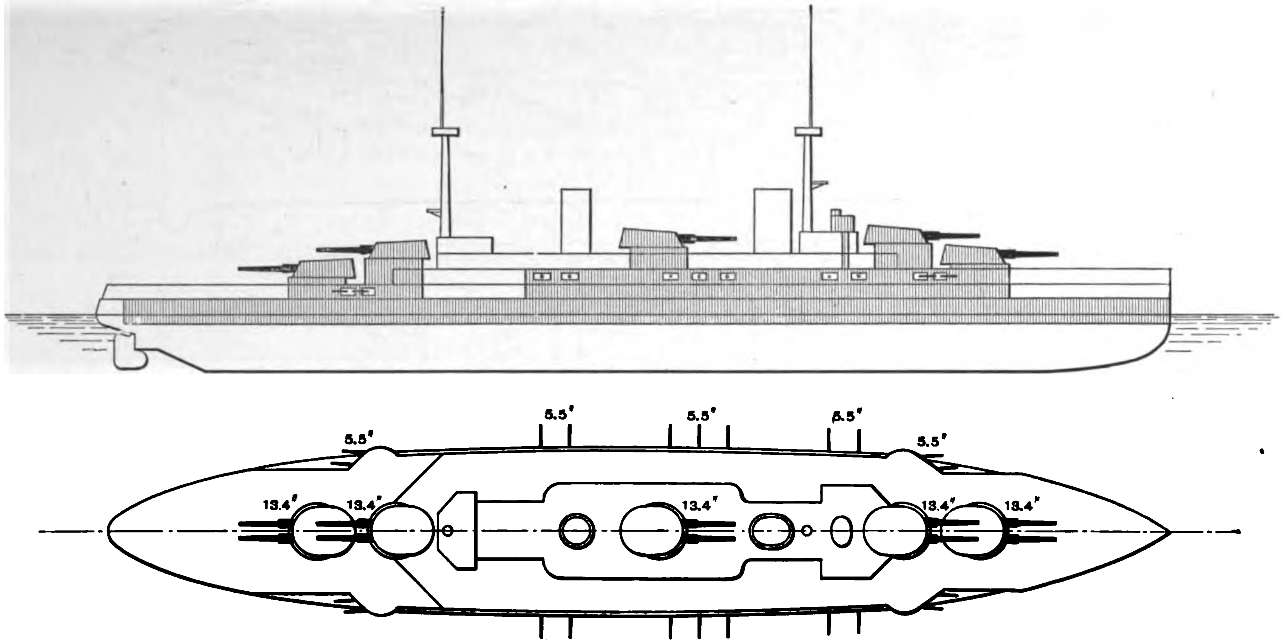


Length, 574 ft.; 25,230 tons; Speed, 21 knots; Building (work suspended); Armament, 12—13·4 in., 24—5·5 in., 4—3 pr.

FRANCE.

BATTLESHIPS.

Bretagne. **Lorraine.**

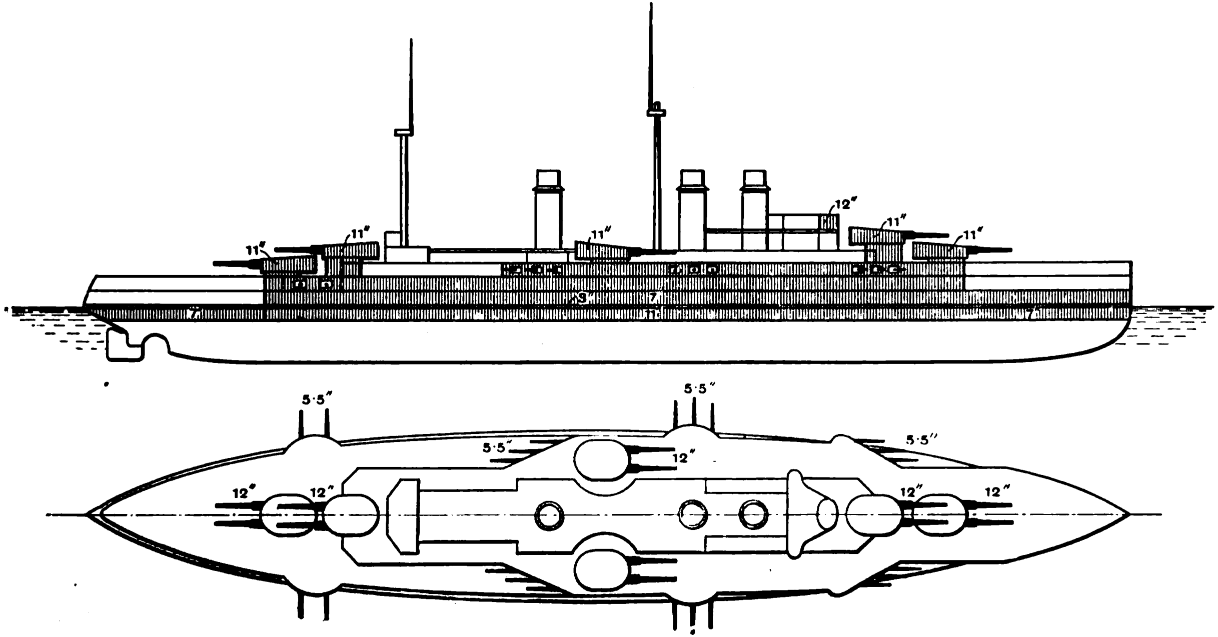


Length, 546 ft. ; 23,177 tons ; Speed, 20 knots ;
Armament, 10—13·4 in., 22—5·5 in., 8 small.

FRANCE.

BATTLESHIPS.

Jean Bart. Courbet. France. Paris.

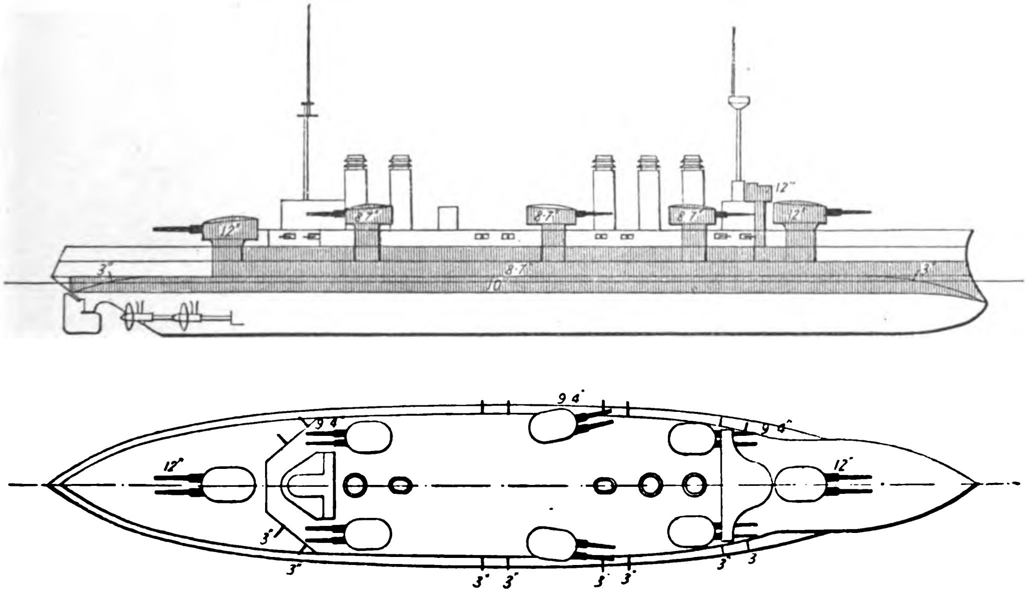


Length, 546 ft.; 23,100 tons; Speed, 20 knots; Completed, 1913-14
Armament, 12—12 in., 22—5·5 in., 4—3 pr.

FRANCE.

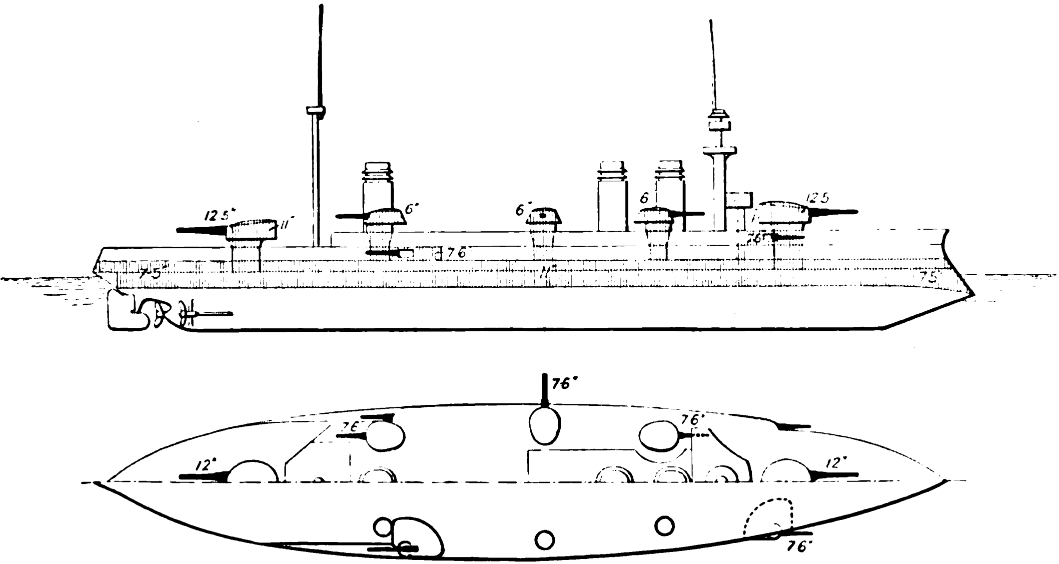
BATTLESHIPS.

Condorcet. **Diderot.** **Vergniaud.** **Voltaire.**



Length, 476 ft.; 18,890 tons; Speed, 19·5 knots; Completed, 1911;
Armament, 4—12 in., 12—9·4 in., 16—12 pr., 10 small.

Démocratie. **Justice.** **Vérité.**

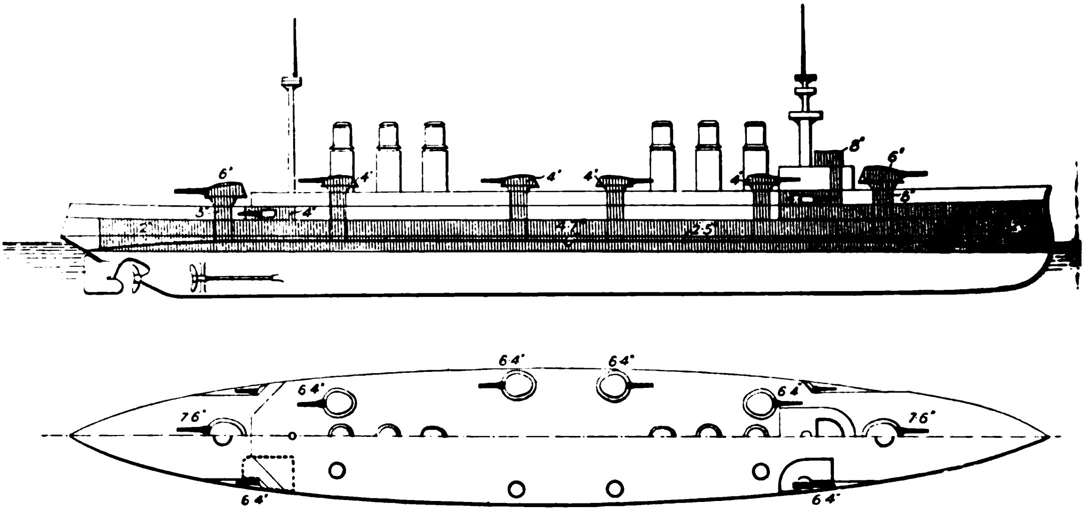


Length, 439 ft.; 14,635 tons; Speed, 19 knots; Completed, 1907–1908;
Armament, 4—12 in., 10—7·6 in., 28 small.

FRANCE.

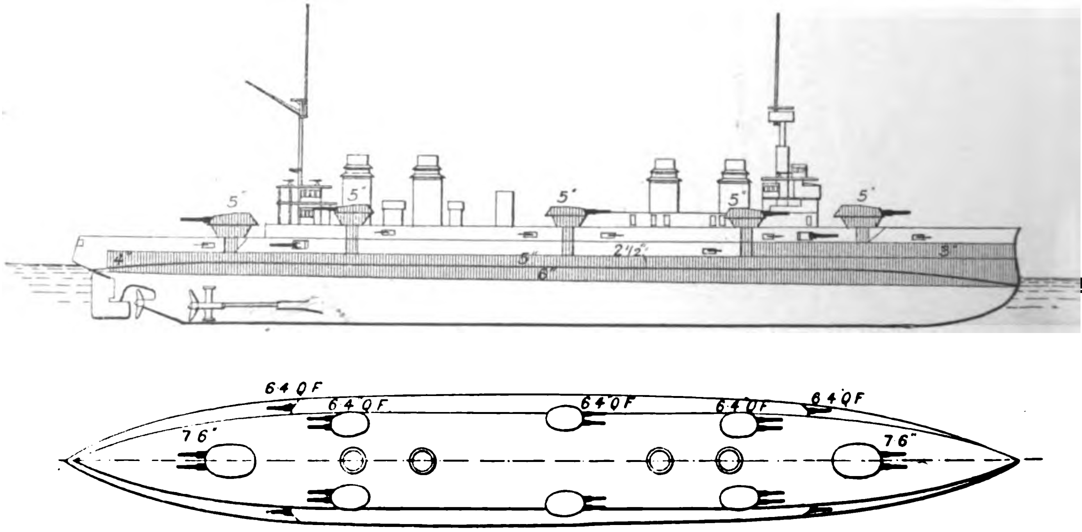
ARMOURED CRUISERS.

Ernest Renan.



Length, 515 ft. ; 13,427 tons ; Speed, 25·5 knots ; Completed, 1909 ;
Armament, 4—7·6 in., 12—6·4 in., 24 small.

Jules Ferry. Victor Hugo

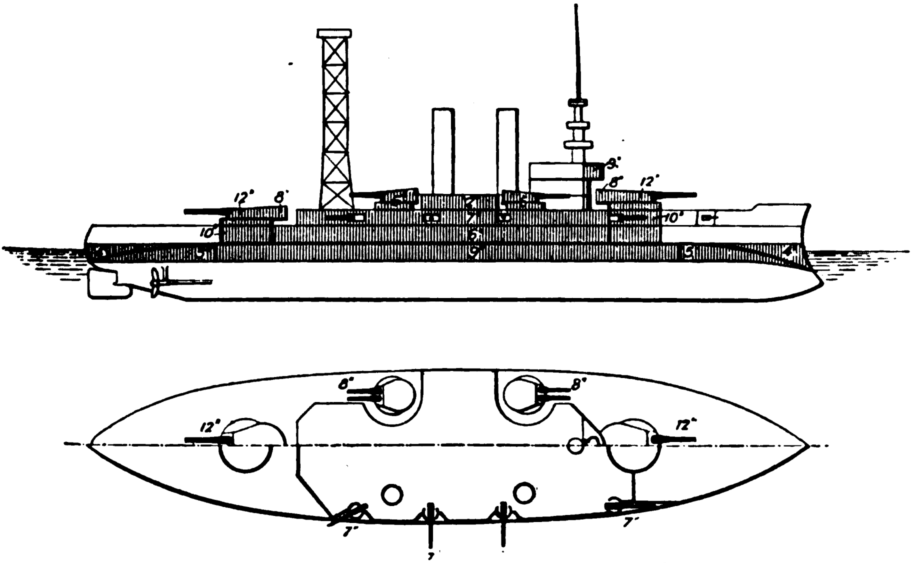


Length, 480 ft. ; 12,351 tons ; Speed, 22·5 knots ; Completed, 1904-1907
Armament, 4—7·6 in., 16—6·4 in., 24 small.

GREECE.

BATTLESHIPS.

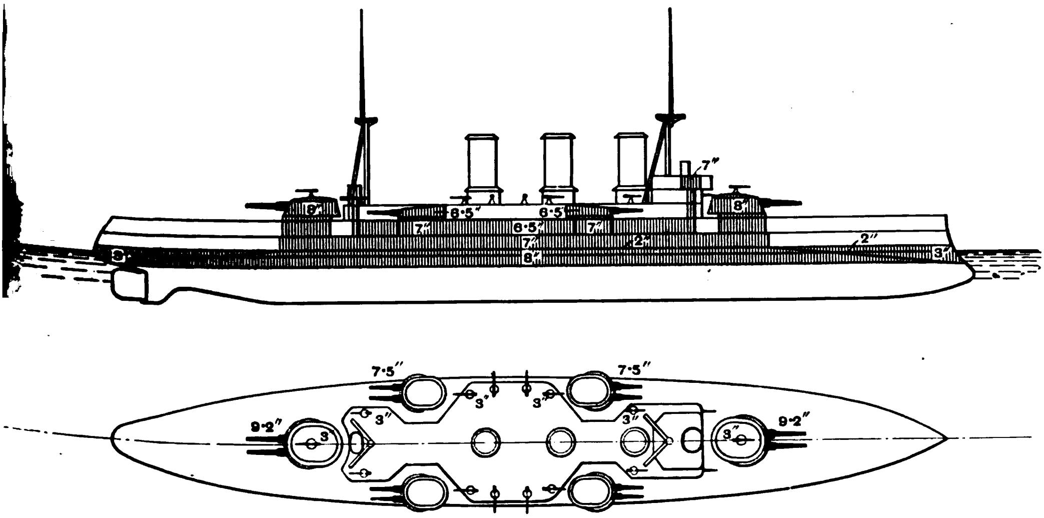
Lemnos (*ex*-**Idaho**). **Kilkis** (*ex*-**Mississippi**).



Length, 375 ft. ; 13,000 tons ; Speed, 17 knots ; Completed, 1908 ;
Armament, 4—12 in., 8—8 in., 8—7 in., 12—3 in., 20 small.

ARMOURED CRUISER.

Giorgios Averoff.

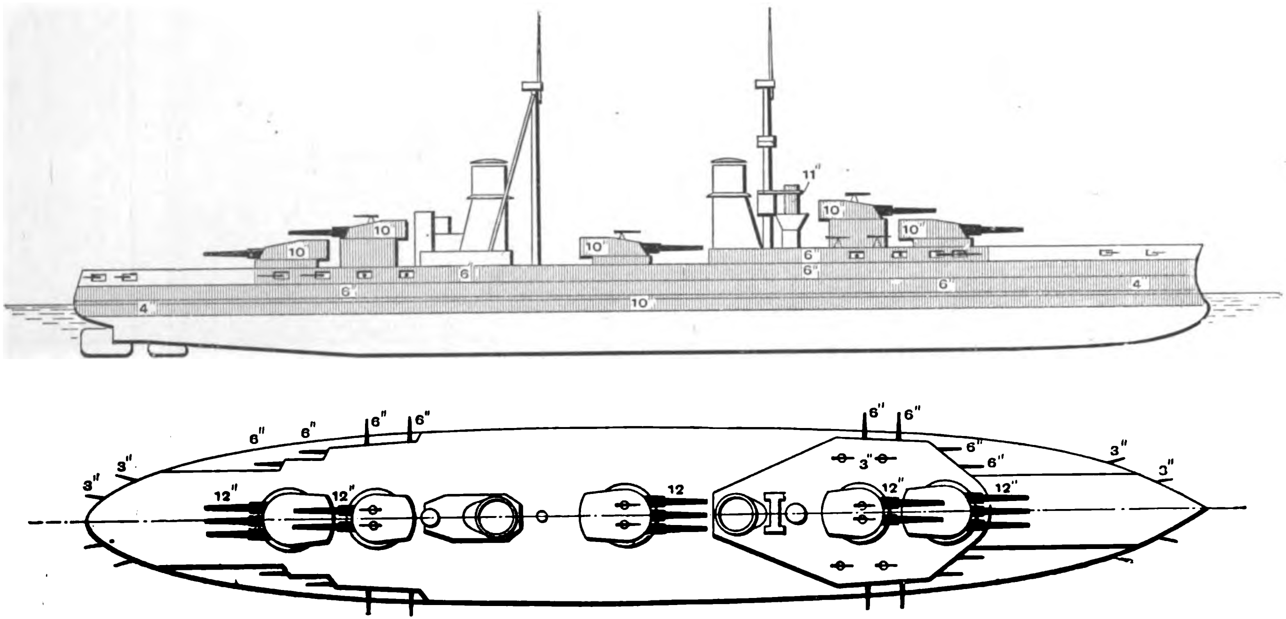


Length, 430 ft. ; 9956 tons ; Speed, 24 knots ; Completed, 1911 ;
Armament, 4—9·2 in., 8—7·5 in., 16—3 in., 8 small.

ITALY.

BATTLESHIPS.

Andrea Doria. **Caio Duilio.**



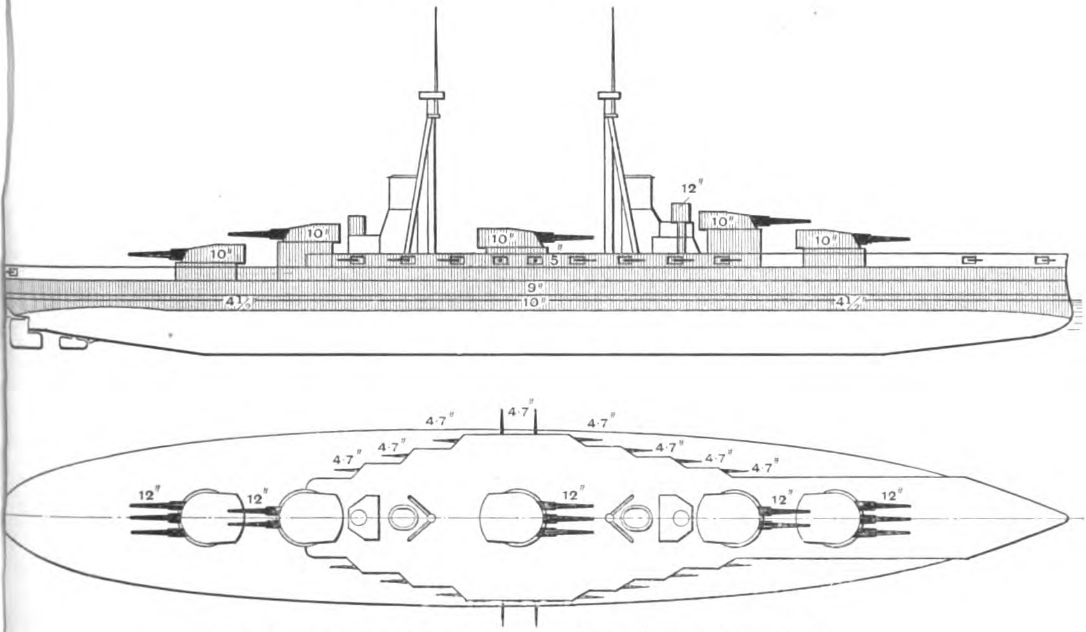
Length, 570 ft. ; 23,025 tons ; Speed, 23 knots ; Completed 1915 ;
Armament, 13—12 in., 16—6 in., 14—12 pr., 6 small.

N.B.—In the next succeeding class, Francesco Morosini, Caracciolo, Cristoforo Colombo, and Marcantonio Colonna, eight 15-in. guns were being mounted in four turrets on the middle line, as in the Queen Elizabeth. Work on these vessels has been stopped.

ITALY.

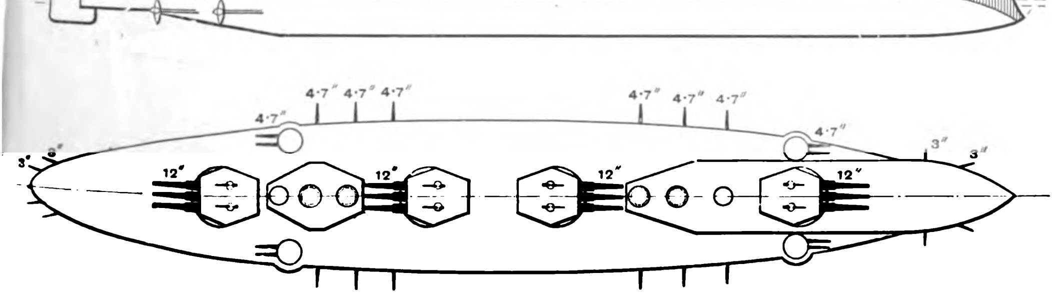
BATTLESHIPS.

Conte di Cavour. Giulio Cesare.



Length, 557 ft. ; 22,340 tons ; Speed, 22·5-23 knots ; Completed, 1914, 1915 ;
Armament, 13—12 in., 18—4·7 in., 14—12 pr.

Dante Alighieri.

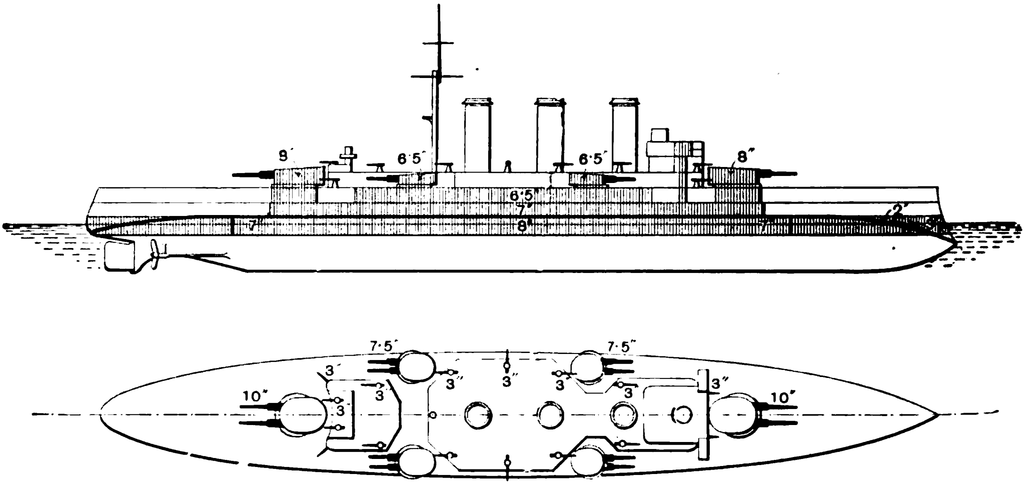


Length, 505 ft. ; 19,400 tons ; Speed, 23·8 knots ; Completed, 1912 ;
Armament, 12—12 in., 20—4·7 in., and small.

ITALY.

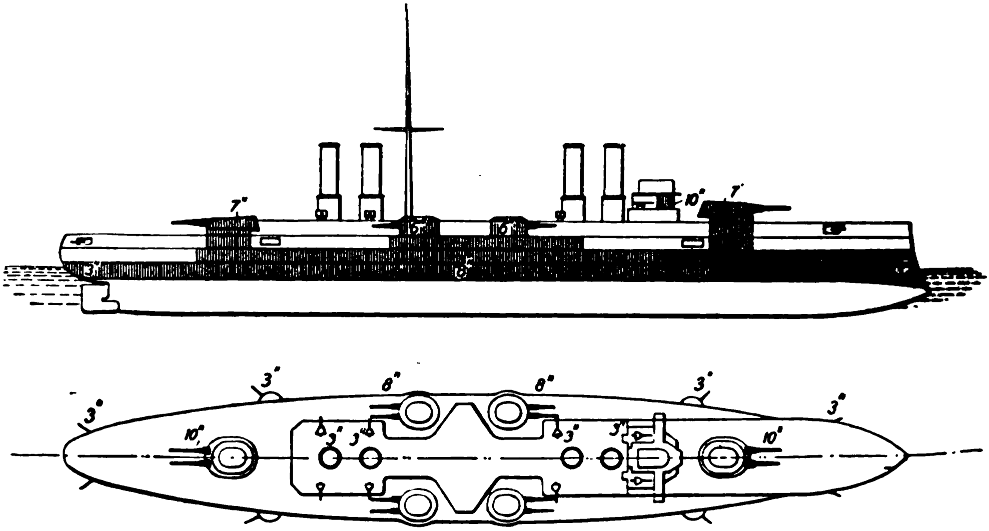
ARMOURED CRUISERS.

Pisa.



Length, 430 ft. ; 9956 tons ; Speed, 23 knots ; Completed, 1909 ;
Armament, 4—10 in., 8—7·5 in., 16—3 in., 2 small.

S. Giorgio. S. Marco.



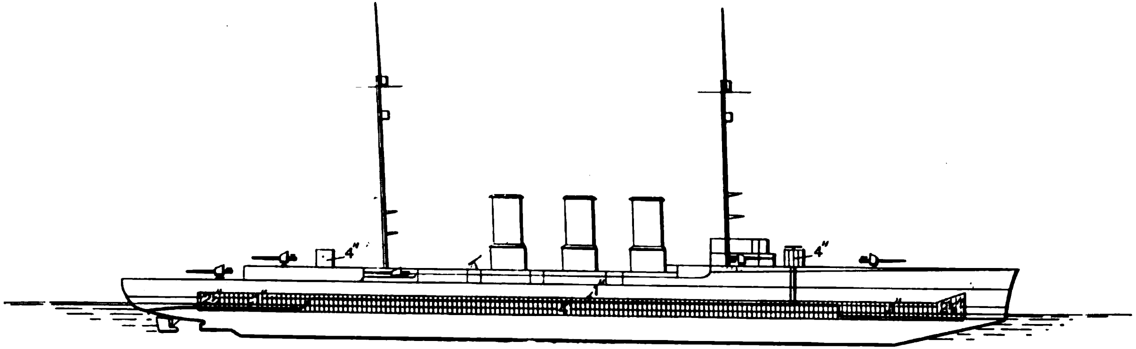
Length, 430 ft. ; 9832 tons ; Speed, 22·5 knots ; Completed, 1910 ;
Armament, 4—10 in., 8—8 in., 16—3 in., 8 small.

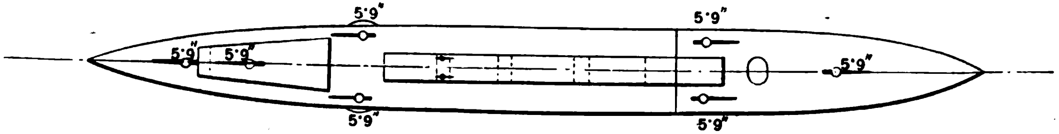
ITALY.

LIGHT CRUISER.

Ancona (*formerly German* **Graudenz**).

(The sister ship **Regensburg** was allocated to France.)





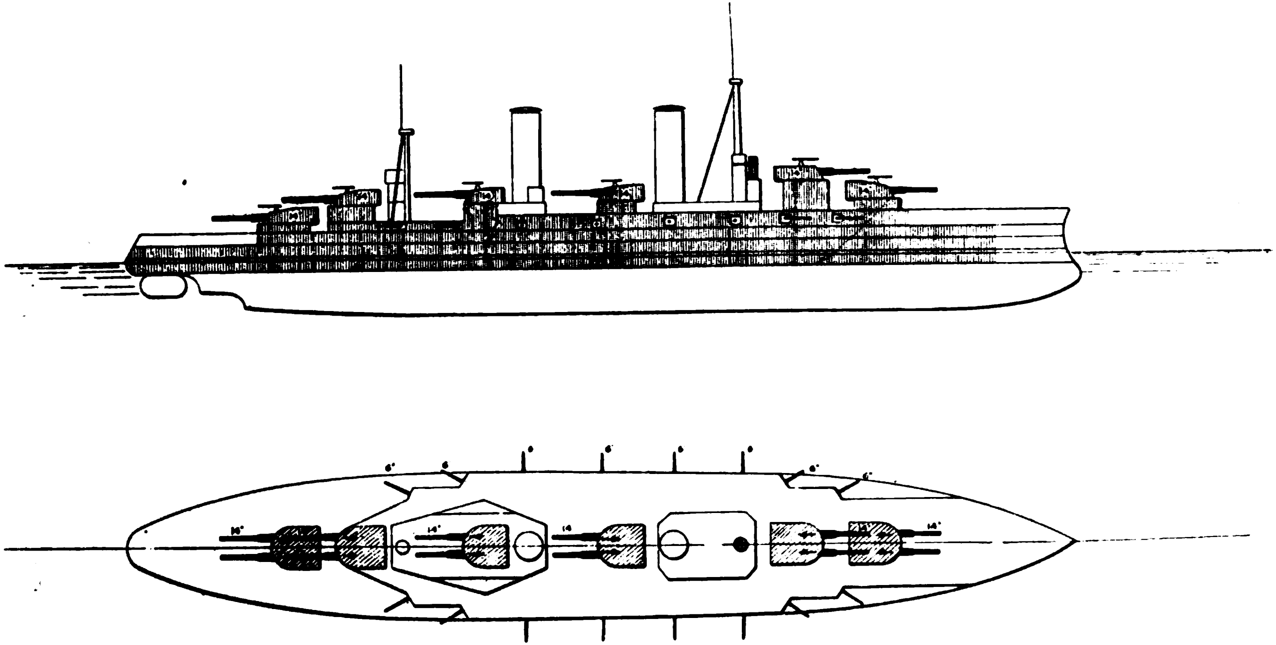
Length, 456 ft. ; 4842 tons ; Speed, 27½ knots ; Completed, 1914-15
Armament, 7—5·9 in., 2—3·4 in. A.A.

NOTE.—The above are typical of the latest *ex*-German Light Cruisers, except the mine-laying cruisers Brummer and Bremse, in which no armour belt was fitted and an all-centre-line armament adopted.

JAPAN.

BATTLESHIPS.

Fuso. Hyuga. Ise. Yamashiro



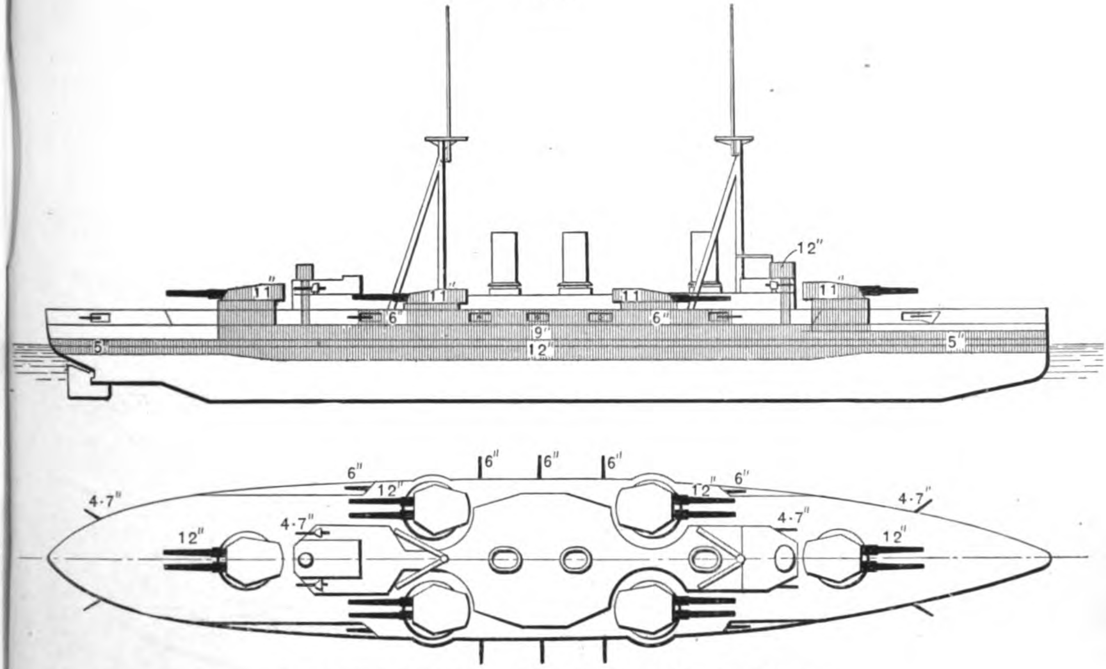
Length, 658 ft.; 31,000 tons; Speed, 22·5 knots; Completed 1915—1918; Armament, 12—14-in., 16—6-in., 4—12 pr.

NOTE.—The armour on the turrets is 12 in., not 14 in. as shown, and, owing to an oversight in the drawing, the armoured substructure of the conning-tower is not shown; also the water-line belt is continued to the bows.

JAPAN.

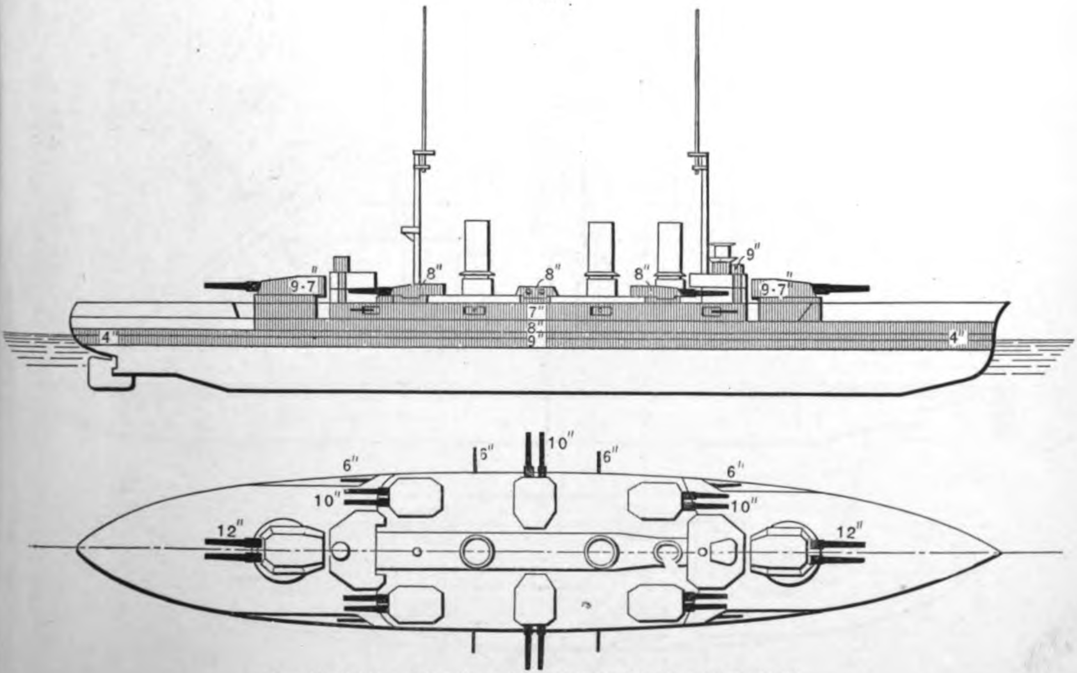
BATTLESHIPS.

Settsu.



Length, 500 ft. ; 20,800 tons ; Speed, 20·5 knots ; Completed, 1912 ;
Armament, 12—12 in., 10—6 in., 8—4·7 in., 16 small.

Aki.

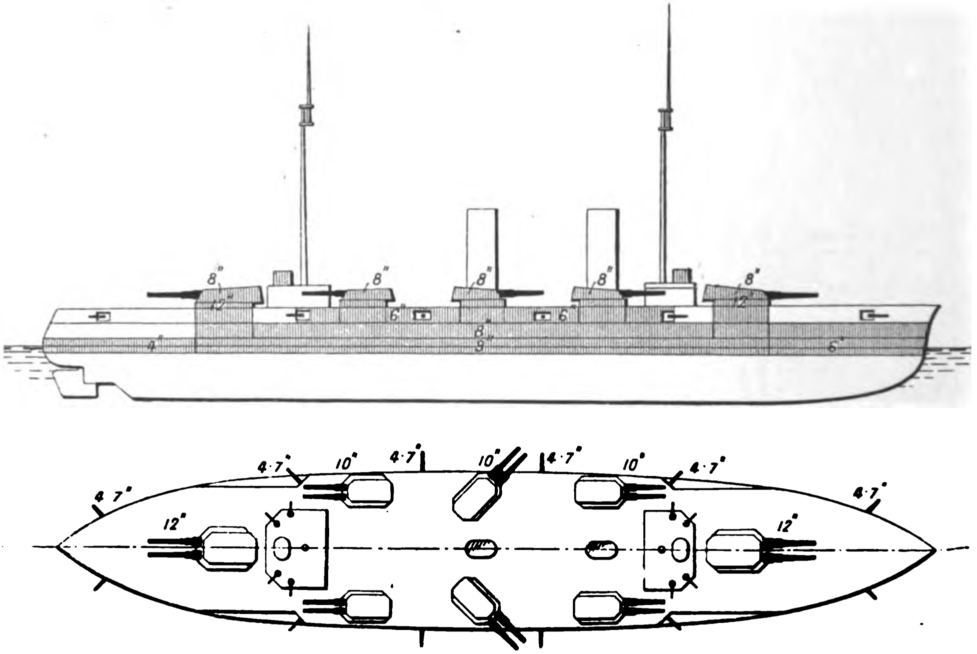


Length, 400 ft. ; 19,800 tons ; Speed, 20·5 knots ; Completed, 1911 ;
Armament, 4—12 in., 12—10 in., 8—6 in., 8—12 pr., 8 small.

JAPAN.

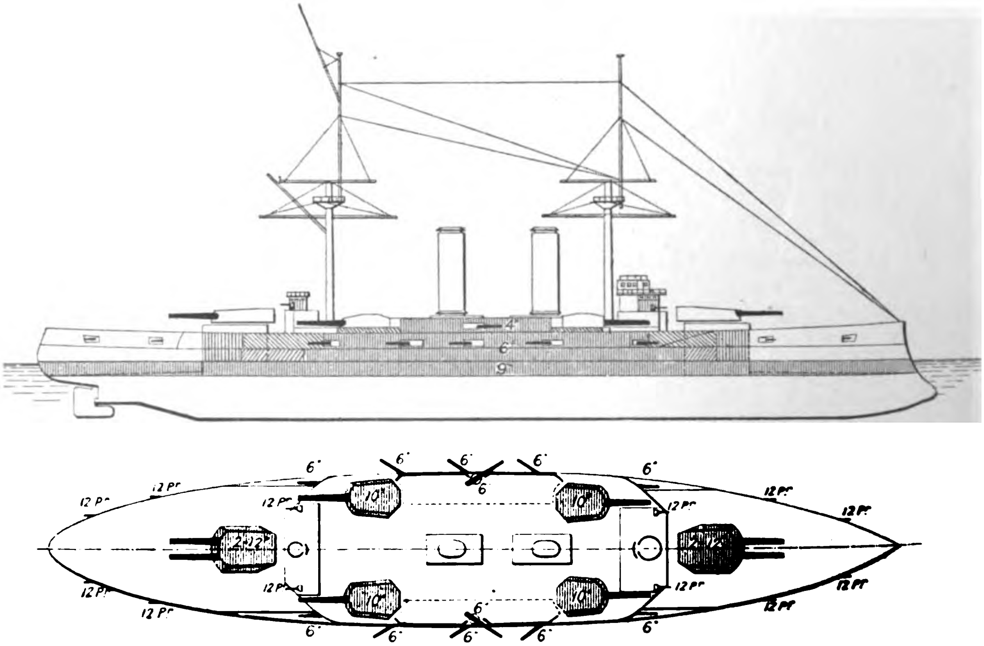
BATTLESHIPS.

Satsuma.



Length, 450 ft. ; 19,350 tons ; Speed, 18·5 knots ; Completed, 1910 :
Armament, 4—12 in., 12—10 in., 12—4·7 in., 4—12 pr., 8 small.

Kashima. Katori.

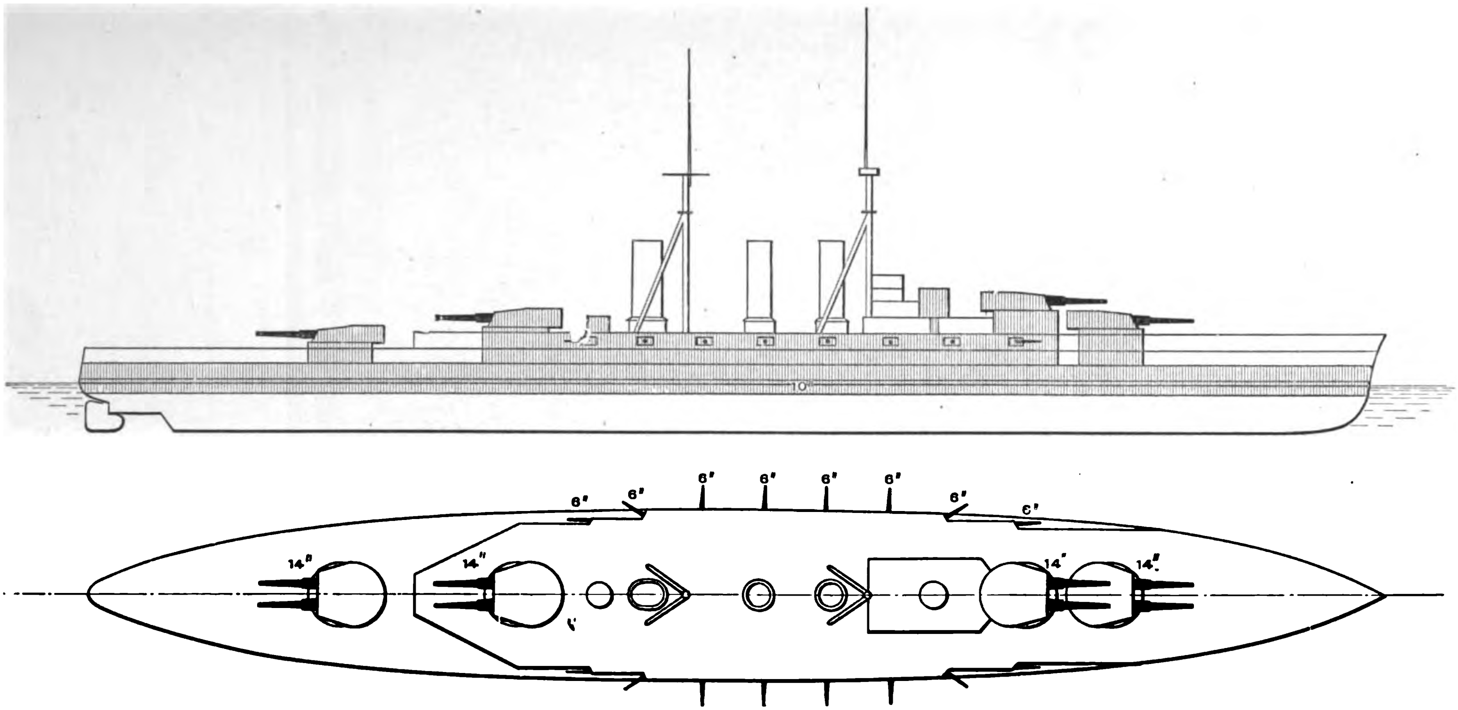


Length, 420–425 ft. ; 15,950–16,400 tons ; Speed, 19·5 knots ; Completed, 1906 ;
Armament, 4—12 in., 4—10 in., 12—6 in., 12—12 pr., 21 small.

JAPAN.

BATTLE-CRUISERS.

Kongo. **Hiyei.** **Haruna.** **Kirishima.**

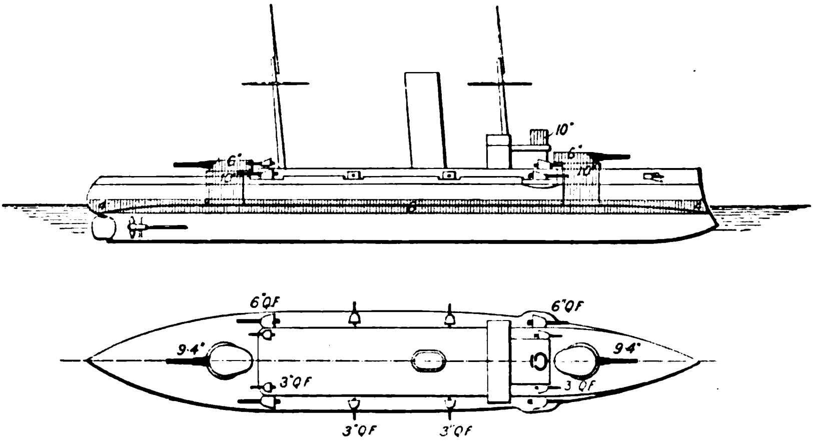


Length. 704 ft. ; 27,500 tons ; Speed, 27 knots ; Completed, 1913--1916 ;
Armament, 8—14 in., 16—6 in., 18 small.

NETHERLANDS.

COAST DEFENCE SHIPS.

De Ruyter. **Hertog Hendrik.** **Koningin Regentes.** **Marten Tromp.**

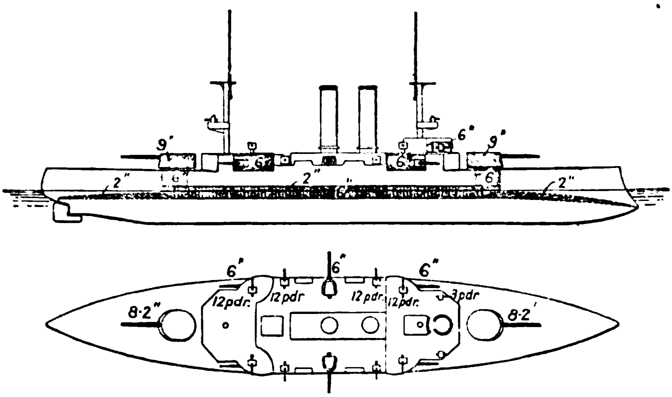


Length, 317 ft. ; 5014—5211 tons ; Speed, 16·5 knots ; Completed, 1902—1906 ;
Armament, 2—9·4 in., 4—6 in., 8—3 in., 4 small.

NORWAY.

COAST DEFENCE SHIPS.

Norge. **Eidsvold.**

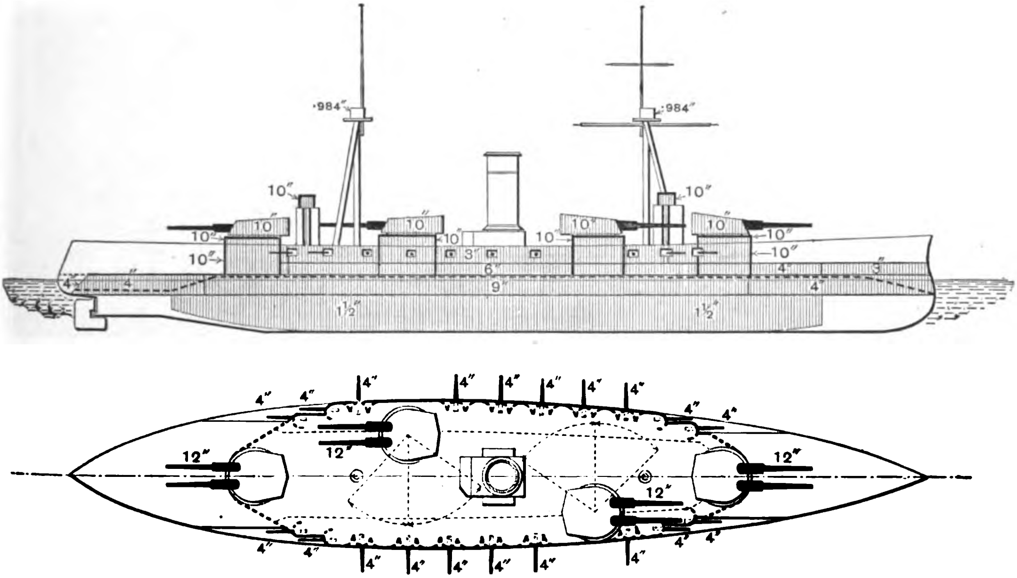


Length, 290 ft. ; 3847 tons ; Speed, 16·5 knots ; Completed, 1901 ;
Armament, 2—8·2 in., 6—6 in., 8—12 pr., 6 small.

SPAIN.

BATTLESHIPS.

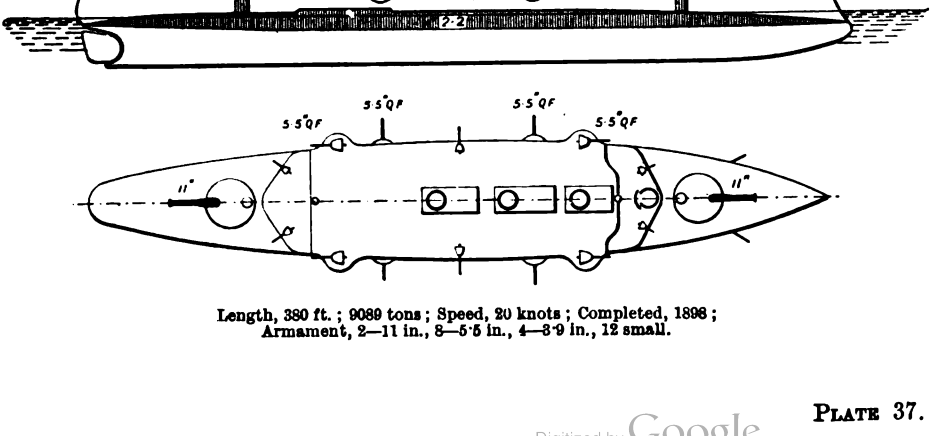
Alphonso XIII. **España.** **Jaime I.**



Length, 435 ft. ; 15,460 tons ; Speed, 19·5 knots ; Completed, 1913-1915 ;
Armament, 8—12 in., 20—4 in., 6 small.

ARMOURED CRUISER.

Emperador Carlos IV.

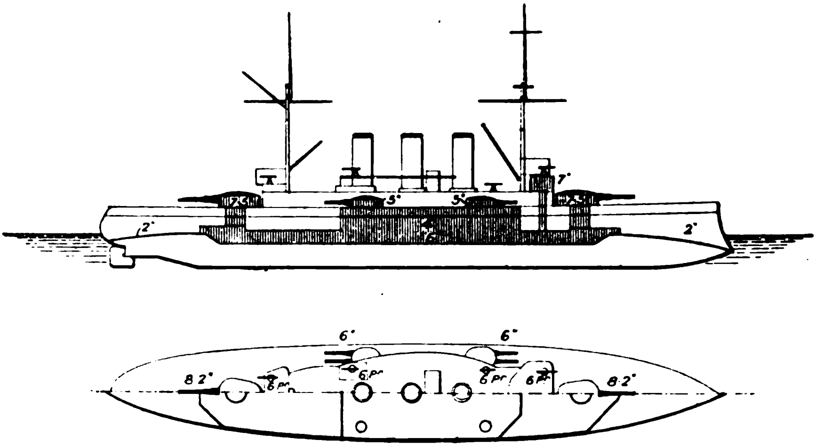


Length, 380 ft. ; 9089 tons ; Speed, 20 knots ; Completed, 1898 ;
Armament, 2—11 in., 8—5·5 in., 4—3·9 in., 12 small.

SWEDEN.

BATTLESHIP.

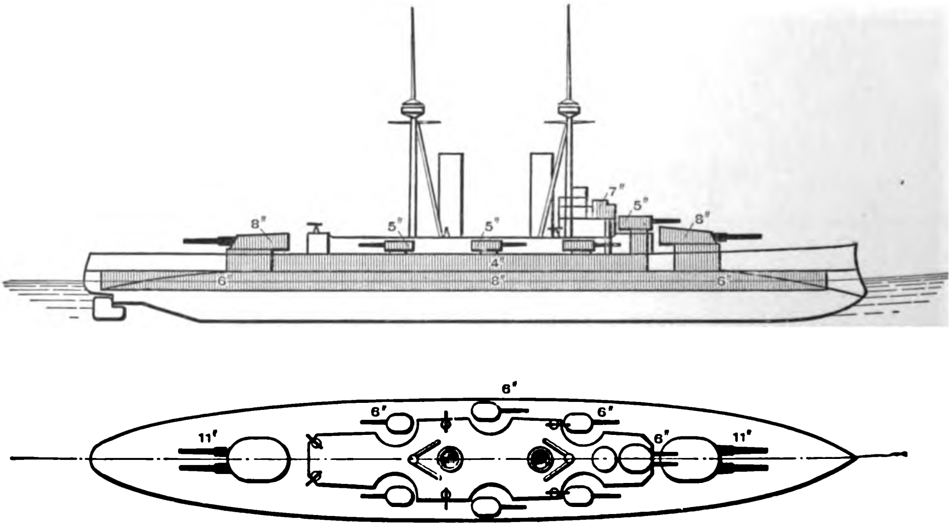
Oscar II.



Length, 314 ft. ; 4203 tons ; Speed, 18 knots ; Completed, 1907 ;
Armament, 2—8·2 in., 8—6 in., 14 small.

ARMOURED CRUISER.

Drottning Victoria. **Gustav V.** **Sverige.**

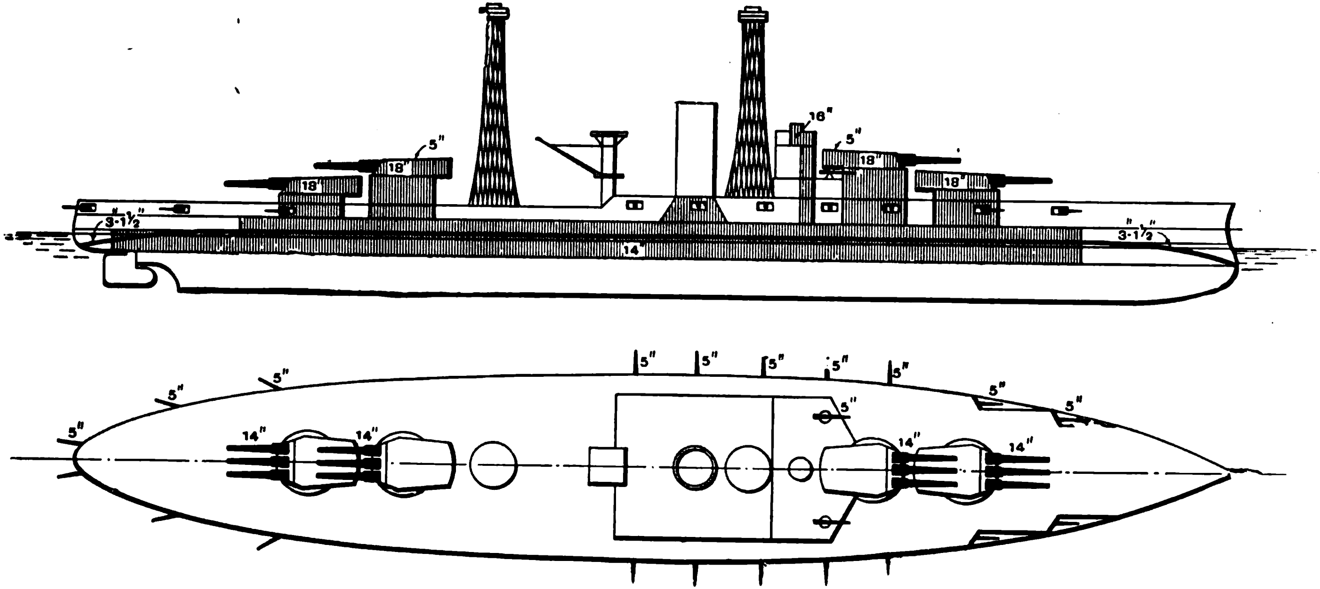


Length, 390 ft. ; 7100 tons ; Speed, 22 knots ;
Armament, 4·11 in., 8—6 in. ; 6—12 pr.

UNITED STATES.

BATTLESHIPS.

Pennsylvania. **Arizona.** **New Mexico.*** **Idaho.*** **Mississippi.***



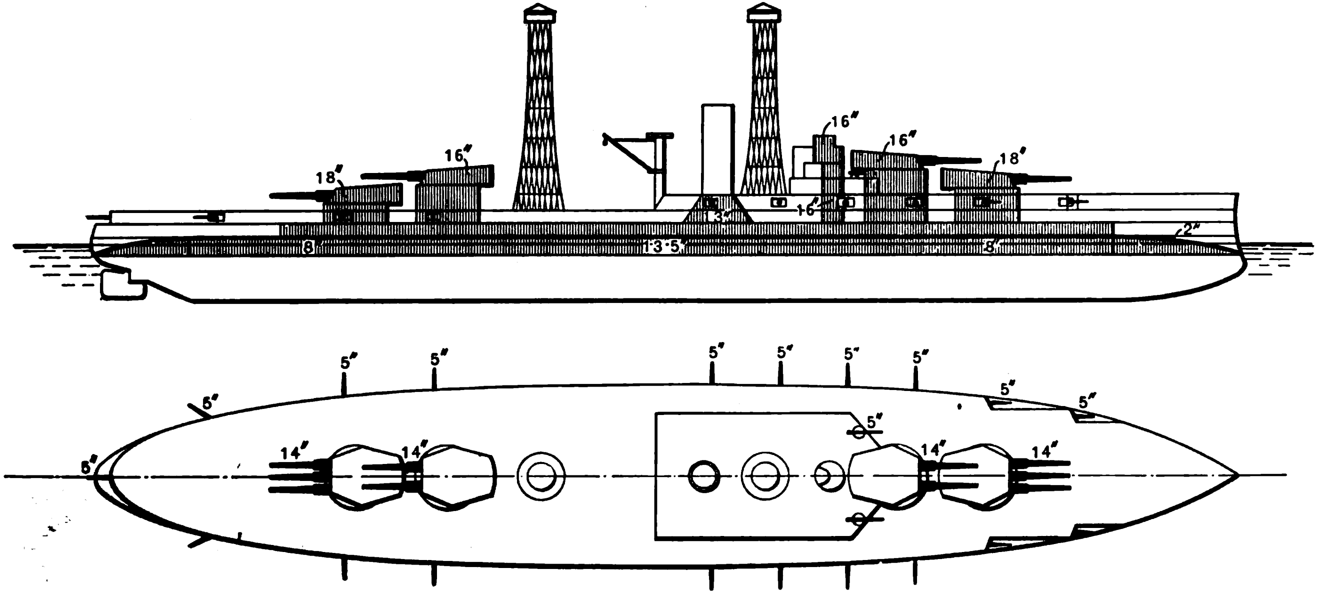
Length, 600 ft.; 31,400 tons; Speed, 21 knots; Completed, 1916—1919;
Armament, 12—14 in., 14—5 in., are now mounted with 4—3 in. A.A.

* The New Mexico (originally named California), Idaho, and Mississippi are of 32,000 tons, and the 5-in. guns are grouped in a central position on a higher level than in the Pennsylvania and Arizona.

UNITED STATES.

BATTLESHIPS.

Nevada. **Oklahoma.**

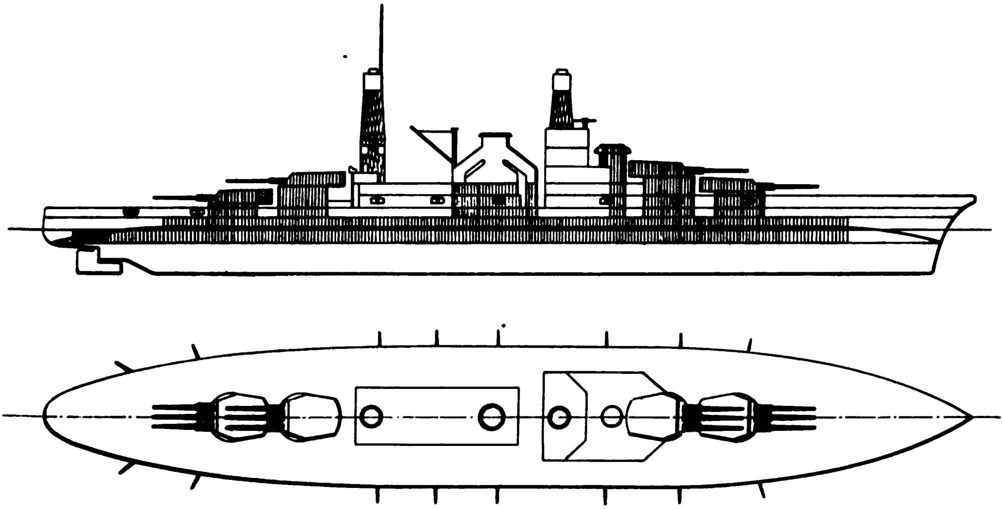


Length, 575 ft.; 27,500 tons; Speed, 20·5 knots; Completed, 1915;
Armament, 10—14 in.; there are now 12—5 in., and 2—3 in. A.A.

UNITED STATES.

BATTLESHIPS.

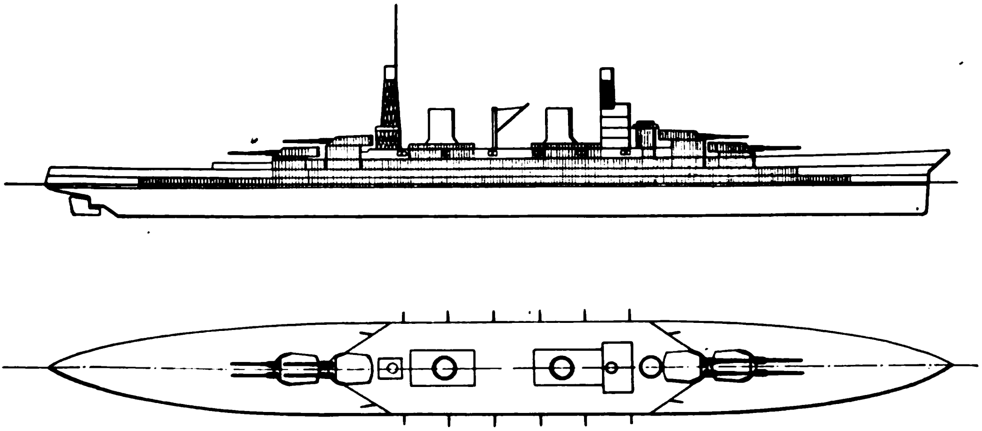
South Dakota. **Indiana.** **Montana.** **North Carolina.** **Iowa.** **Massachusetts.**



Length, 660 ft. ; Speed, 23 knots ;
Displacement, 43,200 tons ; Horsepower, 60,000 ; Armament, 12—16 in. and 16—6 in. ; Torpedo Tubes, 2—21 in. submerged.

BATTLE CRUISERS.

Lexington. **Constellation.** **Saratoga.** **Ranger.** **Constitution.** **United States.**

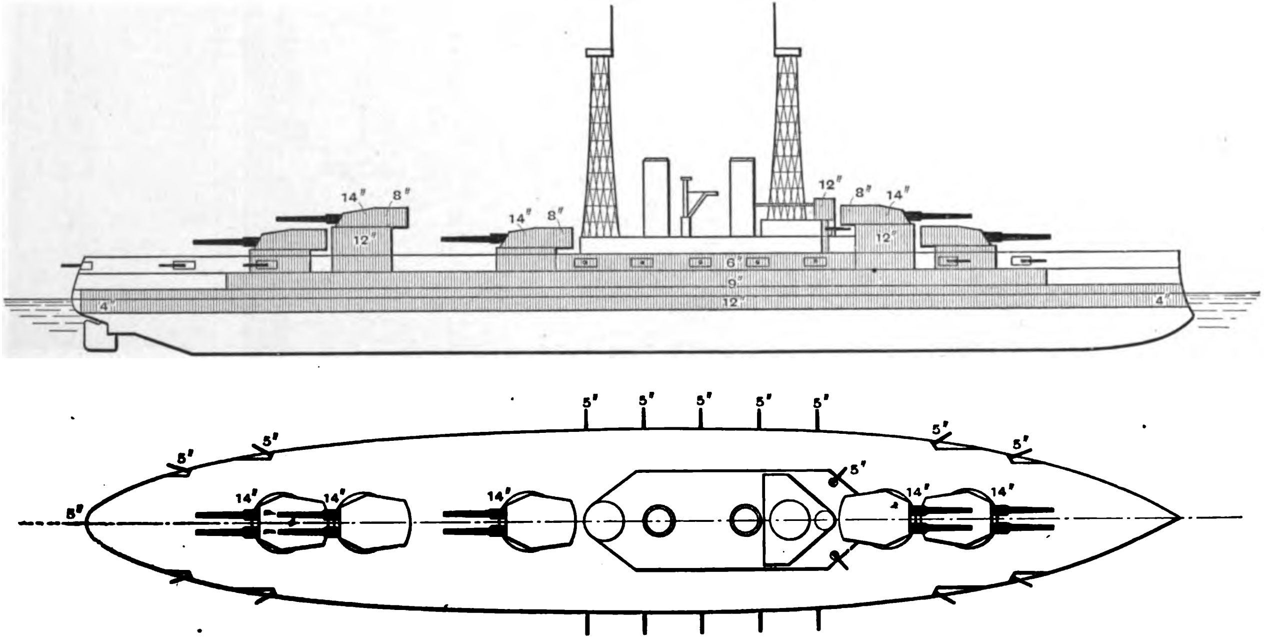


Length, 850 ft. ; Speed, 33·33 knots ;
Displacement, 43,500 tons ; Horsepower, 180,000 ; Armament, 8—16 in. and 16—6 in. ; Torpedo Tubes, 8—21 in. (4 submerged).

UNITED STATES.

BATTLESHIPS.

New York. **Texas.**

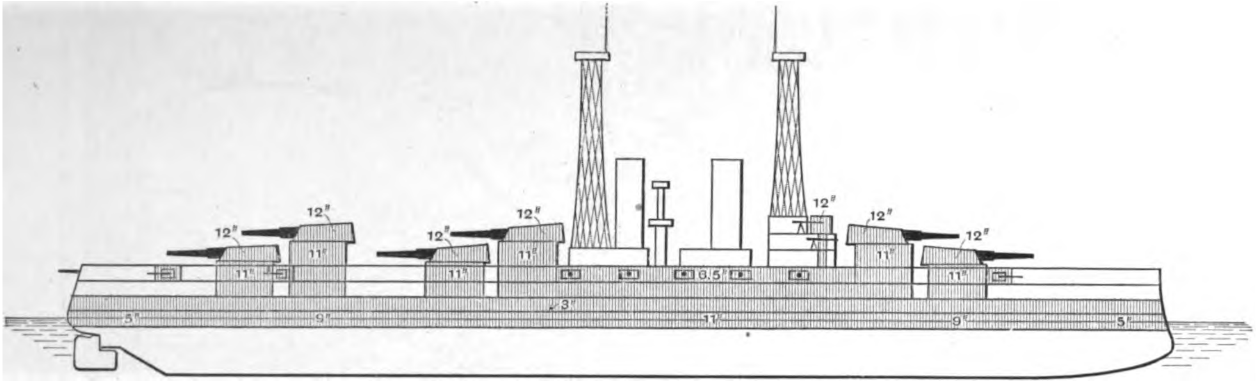


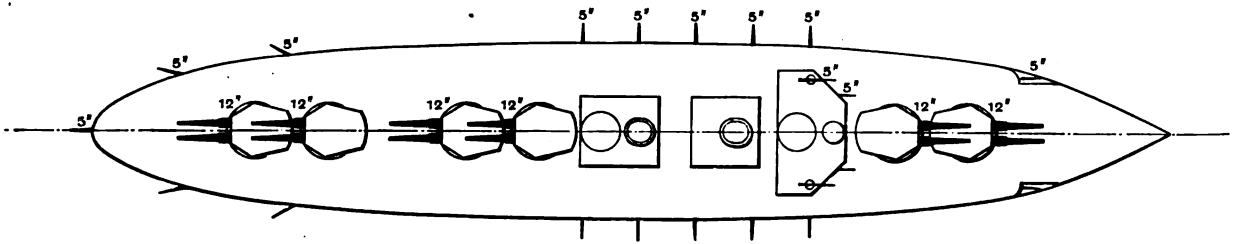
Length, 573 ft. ; 27,000 tons ; Speed, 21 knots ; Completed, 1914 ;
Armament, 10—14 in. The secondary armament has been changed ; there are 16—5 in. and 2—3 in. A.A.

UNITED STATES.

BATTLESHIPS.

Arkansas. **Wyoming.**



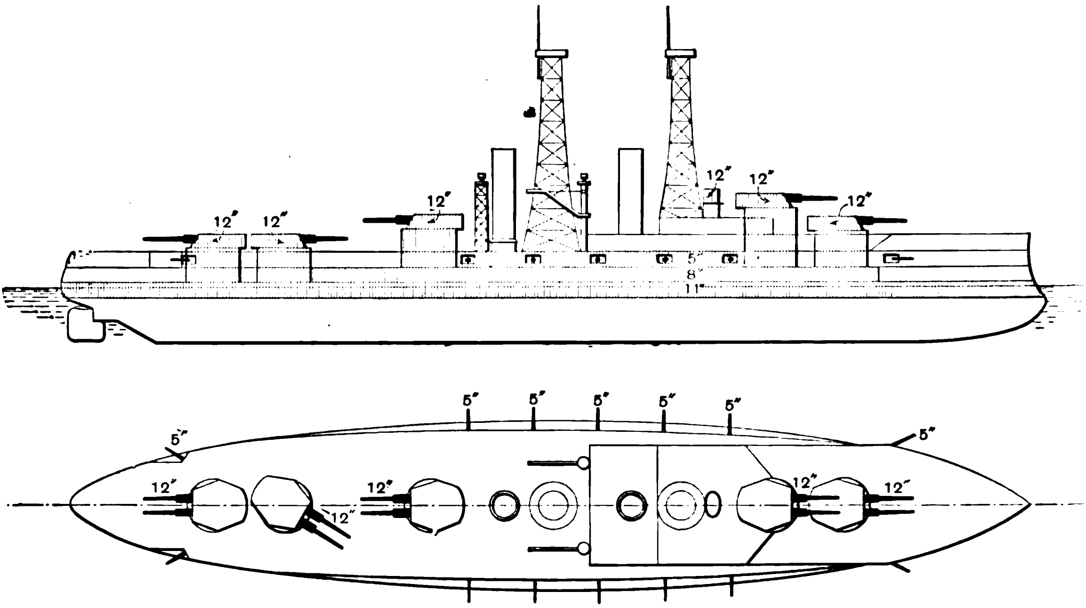


Length, 554 ft. ; 26,000 tons ; Speed, 21 knots ; Completed, 1912 ;
Armament, 12—12 in., new secondary armament, 16—5 in., 2—3 in. A.A.

UNITED STATES.

BATTLESHIPS.

Delaware. **North Dakota.** **Florida.** **Utah.**

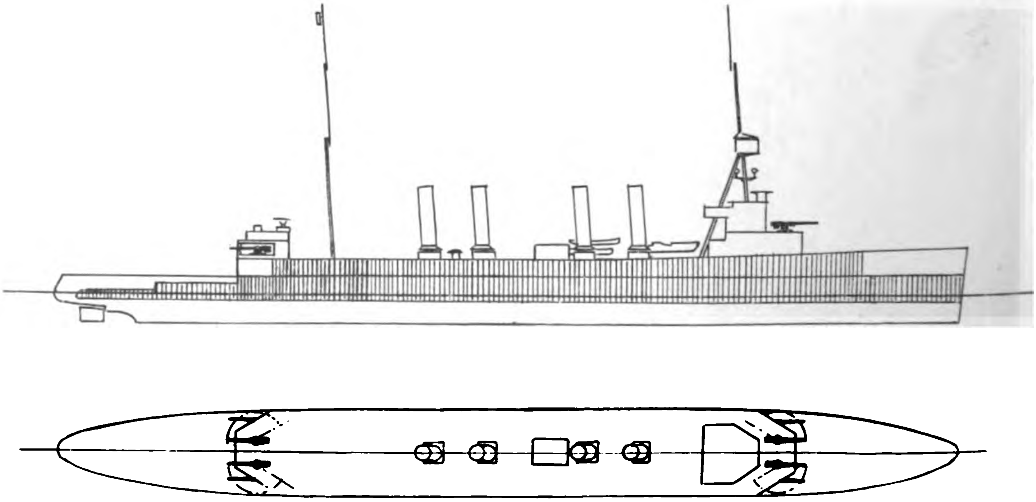


Delaware } Length, 510 ft. ; 20,000 tons ; Speed, 21 knots ; Completed, 1910 ;
North Dakota } Armament, 10—12 in., 14—5 in., 2—3 in. A.A., 16 small.

Florida } Length, 510 ft. ; 21,825 tons ; Speed, 21 knots ; Completed, 1911 ;
Utah } Armament, 10—12 in., now 12—5 in., 19 smaller and A A.

SCOUT CRUISERS.

Nos. 4-13.



Length, 550 ft. ; Speed, 35 knots ;
Displacement, 7100 tons ; Horsepower, 90,000 ; Battery, 8—6 in. ; Torpedo Tubes, 2—21 in. submerged.

BRITISH AND FOREIGN ORDNANCE TABLES.

BRITISH NAVAL ORDNANCE.

	Ordnance.									Charge. (full).	Charge (cordite).		Projectile.						Ballistics (with full charges).					
Nature.					Chamber.		Rifling.														Perforation of wrought iron.			
							Twist one turn in																	
Calibre or Pr.	Weight.	Mark and Service.	Total length in inches.	Length of Bore, including Chamber.	Diameter.	Length to base of projectile.	Least at breech.	Greatest at muzzle.	System.*	Weight.	Weight.	Size.	Diameter.	Weight.	Bursting Charge of Common Shell.	Value of $\frac{d^3}{w}$.	Value of $\frac{w}{d^3}$.	Muzzle velocity.	Total muzzle energy.	Muzzle energy per ton of gun.	At muzzle.	At 1000 yards range.	At 2000 yards range.	At 3000 yards range.
QUICK-FIRING GUNS				cals.	ins.	ins.	cals.	cals.		lbs.	lbs. ozs.		ins.	lbs.	lbs.			f. s.	ft. tons.	ft. tons.	ins.	ins.	ins.	ins.
6·0 in	7 tons	I. & III. II. (Wire)	249·25	40	..	..	60	30	P.	..	13 4	30	6·0	100·0	..	0·360	0·463	2200	3356	479	15·9	12·7	10·2	8·2
6·0 in.	5 „	I. to VI.	169·1 166·6	26·2 26·6	.. ..	.. ..	.. ..	.. ..										1913	2537	362	13·0	10·3	8·2	6·4
4·7 in.	41 cwt. 42 „	I. II. III. & IV. Wire	194·1	40	..	..	100 0	34·4 30	E.O.C.	..	5 7	20	4·72	45·0	..	0·495	0·428	2188	1494	711	12·4	9·2	6·6	5·0
4 in.	26 cwt.	I. II. III. Wire converted guns	165·25 120	40 28	..	..	..	30	M.Pl.	..	3 9	15	..	25·0	..	0·640	0·390	2300 2177	917 821	705 569	10·5 9·5	6·9 6·5	4·9 4·6	3·3 3·0
12-pr.	12 cwt.	I.	123·6	40	..	..	120 0	28 30	E.O.C. M.Pl.	..	1 15	10	3·0	12·5	..	0·072	0·463	2210	423	677	8·1	5·3	3·5	2·4
12-pr.	8 cwt.	I.	87·6	28	..	..	60 0	28 30	E.O.C. M.Pl.	..	13¾	10	3·0	12·5	..	0·072	0·463	1607	223·8	544	4·9	3·2	2·4	..
Hotchkiss . 6-pr...	8 cwt.	I. & II.	97·63	40·0	..	..	180	29·9	M.Pl.	..	b7¾	5	2·24	6·0	..	0·836	0·534	1818	137·5	344·8	4·8	2·8	..	..
Nordenfelt . 6-pr...	6 cwt.	I. II. & III.	104·4	42·3	..	..																		
Hotchkiss . 3-pr...	5 cwt.	I. & II.	80·63	40	..	..	25	25	M.Pl.	..	b6⅜	5	1·85	3·3	..	1·037	0·521	1873	80·3	321·2	4·1	2·1	..	..
Nordenfelt . 3-pr...	4 cwt.	I. L.	91·5	45·4									..	..	..	..	..	1920	84·3	337·2	4·3	2·2	..	..
MACHINE GUNS.										grains.				grs.										
Maxim, 1 bar 0·45 in.	63 lbs.	I.	45·0	..	..	..	10	27	Enf'ld	31 Cordite	..	..	0·450	480	..	2·952	0·751	..	..	..	Same as M.H. Rifle.			
Maxim, ·303 . .			42·38				10	25·6	Metf'd				0·303	215	..	..	..	..	..	..	Same as Lee-Metford.			

BRITISH NAVAL ORDNANCE—*continued.*

Ordnance.										Charge (cordite).		Projectile.						Ballistics (with full charges).					
	Nature.				Chamber.		Rifling.												Perforation of wrought iron.				
							Twist one turn in.																
Calibre or Pr.	Weight.	Mark and Service.	Total length in inches.	Length of Bore, including Chamber.	Diameter (at largest).	Length to base of projectile.	Least at breech.	Greatest at muzzle.	System.†	Weight.	Size.	Diameter.	Weight.	Bursting Charge of Common Shell.	Value of $\frac{d^2}{w}$.	Value of $\frac{w}{d^3}$.	Muzzle velocity.	Total muzzle energy.	At muzzle.	At 1000 yards range.	At 2000 yards range.	At 3000 yards.	Perforation Krupp steel, 3000 yards. Uncapped Shot.
B.L. GUNS.				cals.	ins.	ins.	cals.	cals.		lbs. oz.		ins.	lbs.	lbs. oz.			f. s.	ft. tons.	ins.	ins.	ins.	ins.	ins.
16·25-in.	110½ tons.	III.	524·0	30·0	21·125	84·5	newer patterns.	30	Modified Pl. Section, the last in the new guns.	960‡ S.B.C.	..	16·25	1800	‡‡193 **179½	0·147	0·420	2087	54,390	38·0	34·6	31·7	29·4	13
13·5-in.	69 & 67 tons.	I. II. III.& IV.	433·0	30·0	18·0	66·5		30		187 8	..	13·5	1250	**85	0·146	0·508	2016	35,230	33·0	30·2	27·6	25·2	11
12-in.	46 tons.	VIII. Wire	445·5	35·43	16·0	70·0		30		167 8	50	12·0	850	80–1$\frac{9}{11}$	0·169	0·492	2367	33,020	37·0	32·7	29·4	26·6	11½
12-in.	50 tons.	IX. Wire	496·5	40·0	17·5	87·2		..		201 8 9 8	50 3¾	12·0	850	”	..	..	2481 §2580	36,290 39,280	39·7 42·0	35·4 38·0	31·6 34·6	28·7 32·0	12½ 14
12-in.	58 tons.	X. Wire*	558·0	45·0	..	..		..		325 0 M.D.	..	12·0	850	..	..	..	2900	47,697	51·0	46·2	42·0	38·4	17
10-in.	31 tons.	Triumph & Swiftsure	483·0	45·0	14·0	64·5		..		..	..	10·0	500	..	..	..	§2800	§27,205	39·5	34·6	30·2	27·0	11¾
10-in.	29 tons.	II. III. III.A & IV.	342·4	32·0	14·0	54·0		30		76 0	30	10·0	500	37¾	0·200	0·500	2040	14,430	24·8	21·8	19·3	17·0	7½
9·2-in.	21 & 22 tons.	I. & II.	255·8	25·56	11·0	44·0		35		42 0	30	9·2	380	18 ‡‡33 **30$\frac{6}{16}$	0·223	0·488	1781	8,356	18·3	15·9	14·4	12·4	5½
9·2-in.	24 & 22 tons.	III. V. VI. VI.A&C & VII.	310·0	31·5	12·0	43·0		30		53 8	30	9·2	380		0·223	0·488	2065	10,910	22·9	19·8	17·2	15·5	6¾
9·2-in.	25 tons.	Wire VIII.	384·0	40·08	10·5	53·15		..		68 0	40	9·2	380	..	0·223	0·488	2347	14,520	27·6	23·9	20·7	18·0	7¾

9·2-in.	28 tons.	Wire X.	442·35	46·6	13·0	71·215	Various in the	..	P. Elswick, Hook, or	103	0	44	9·2	380	..	0·223	0·488	2640 §2800	18,400 20,685	33·3 36·0	28·9 31·2	25·0 27·4	22·0 24·0	9½ 10½
7·5-in.	16 tons.	Triumph & Swiftsure	386·7	50·0	..	46		..		..		..	..	200	..	0·281	0·474	§2800	10,883	29·0	24·9	21·4	17·8	7¾
7·5-in.	14 tons.	..	337·5	45	11·1	55		30		47 2	0 8	30 2½	7·5	200	18½	0·281	0·474	2600	9,340	26·0	22·3	18·8	15·7	6¾
6-in.	5 tons.	III.	170·7	25·53	8·0	26·75		35		14	12	20	6·0	100	$7\frac{4}{16}$ **$9\frac{13}{16}$	0·360	0·463	1960	2,665	13·4	10·7	8·9	7·0	3
6-in.	5 tons.	IV. VI.	173·5	26·0	8·0	26·75		35 80					6·0											
6-in.	7·4 tons.	VII. VIII.	269·5	45	8·5	32·7		30		20	0	20	6·0	100	9	0·360	0·463	2493 §2750	4,308 5,250	19·6 22·3	15·3 18·0	11·9 14·6	9·8 11·6	4¼ 5
4-in.	23 cwt. 26 cwt.	II.II$_P$ III.III$_A$ IV.V.& VI.	120·0	27·0	5·3	18·5	120	30		3	1	5	4·0	25	$1\frac{12}{16}$ $3\frac{3}{16}$	0·640	0·391	1900	625	7·7	5·4	4·0	3·0	..

* Some details of the 12-in. Mark X. uncertain.

† P. means Polygroove; Pl., Plain; ‡ Cordite has not been introduced for this gun; § Estimated with M.D. cordite; ** Cast steel; ‡‡ Forged steel.

FRENCH NAVAL ORDNANCE.

Date and Pattern of Gun.	Model 1913.	Model 1906.	Model 1902.	Model 1893–96.				Model 1893.				
Desig. by Calibre, in cms.	34	30·5	30·5	30·5	27·44	24·0	19·4	34·0	30·5	27·44	24·0	19·4
Calibre, in inches	13·4	12·01	12·01	12·01	10·8	9·45	7·64	13·39	12·0	10·8	9·45	7·64
Total length, in feet	..	..	..	..	..	..	..	..	..	..	..	..
Length of Bore, in ins.	..	..	..	..	..	..	..	..	..	..	..	..
Length of Bore, in cals.	45	50	45	40	40	45	45	35	40	40	40	40
Total weight, in tons	66	45	..	44·4	34·5	23·6	12·5	52·9	45·9	34·9	22·4	10·6
Weight of Firing Charge, Armour-piercing Projectile . lb.	..	..	..	246	188·5	145½	74	243·0	198·4	114·6	110·2	44·1
Weight { Armour-piercing Projectile . lb.	1190	969	750	750	562	375	190	925·9	643·8	476·2	317·5	165·3
Weight { Common Shell . ”	..	..	..	750	562	375	190	925·9	643·8	476·2	317·5	165·3
Muzzle Velocity, in f.-s., A.P. Projectile	..	2871	2870	2650	2650	2870	2870	2400	2625	2625	2625	2625
Muzzle Energy { Total, in f.-t.	65340	54843	42890	36782	27186	21445	10890	36850	30750	22750	15170	7898
Muzzle Energy { Per in. circ., f.-t.	..	..	..	..	..	..	..	..	815·8	670·7	511·1	329·1
Perforation at Muzzle,† wrought iron, inches	..	..	46·0	42·7	38·8	37·0	29·0	36·8	37·3	33·7	29·4	23·4
Perforation Krupp Steel, 3000 yds.	11·8 (9000 mètres)	..	15½	13½	11½	10½	6¾	11½	11	9	7½	5½

Corrected to 1920.

† By Tresidder's formula.

UNITED STATES NAVAL ORDNANCE.

GUN.	MARK.	Length in Calibres.	Total Length	Capacity of Chamber in Cubic Inches.	Travel of Projectile in Inches.	Weight of Gun.	Weight of Projectile.	Weight of Charge.	Muzzle Velocity.	Muzzle Energy.	Penetration at Muzzle, Krupp Armour, using Capped Projectile.	At 3000 Yards.		At 6000 Yards.		At 9000 Yards.	
												Remaining Velocity.	Penetra-tion.	Remaining Velocity.	Penetra-tion.	Remaining Velocity.	Penetre-tion.
			inch.			tons.	lb.	lb.	ft.-seconds.	ft.-tons.	inch.	ft.-seconds.	inch.	ft.-seconds.	inch.	ft.-seconds.	inch.
3-in. R.F.G.	II., III.	50	154	219	128·3	0·9	13	3·85	2700	658	3·3	1230	1·2	848	0·8	..	..
3-in. S.A.	V., VI.†	50	159	219	128·3	1·0	13	3·85	2700	658	3·3	1230	1·2	848	0·8	..	..
4-in. R.F.G.	III., IV., V., VI.	40	164	331	134·5	1·5	33	4·85	2000	915	3·4	1156	1·7	897	1·2	..	..
4-in. R.F.G.	VII.	50	205	652	168·3	2·6	33	9·0	2500	1,430	4·6	1432	2·2	979	1·4	853	1·2
4-in. R.F.G.	VIII.‡	50	205	652	168·3	2·9	33	12·3	2800	1,794	5·3	1627	2·6	1033	1·5	878	1·2
5-in. R.F.G.	II., III., IV.	40	206	656	165·8	3·1	50	10·0	2300	1,852	5·3	1286	2·6	934	1·7	829	1·4
5-in. B.L.R.	V., VI.	50	256	1,200	215·6	4·6	60	19·2	2700	3,032	6·2	1692	3·5	1102	2·0	928	1·6
5-in. B.L.R.	VI.	50	256	1,200	215·6	4·6	50[1]	20·5	3000	3,122	6·4	1732	3·2	1057	1·7	877	1·4
5-in. R.F.G.	VII.§	51	261	1,135	215·6	5·0	50	23·8	3150	3,439	6·8	1835	3·4	1091	1·8	895	1·4
6-in. R.F.G.	II., III.	30	196	1,287	150·0	4·8	105	18·8	1950	2,768	5·3	1305	3·2	1009	2·3	909	2·0
6-in. R.F.G.	IV., VII.	40	256	1,320	205·8	6·0	105	18·8	2150	3,365	6·0	1440	3·6	1058	2·4	934	2·1
6-in. R.F.G.	IX.	45	270	1,320	221·7	7·0	105	18·8	2250	3,685	6·3	1511	3·8	1086	2·5	948	2·1
6-in. B.L.R.	VI.	50	300	2,101	247·5	8·3	105	30·0	2600	4,920	8·6	1770	4·7	1207	2·9	996	2·2
6-in. B.L.R.	VIII.	50	300	2,101	247·5	8·6	105	37·0	2800	5,707	11·3	1923	5·2	1297	3·2	1026	2·3
7-in. B.L.R.	II.	45	323	3,643	259·8	12·7	165	58·0	2700	8,338	9·6	1948	6·4	1382	4·2	1083	3·0
8-in. B.L.R.	III., IV.	35	305	3,170	245·8	13·1	260	43·8	2100	7,948	8·6	1576	6·0	1206	4·2	1040	3·6
8-in. B.L.R.	V. and VI.	45	369	5,243	299·1	18·7	260	98·5	2750	13,360	12·0	2106	8·6	1589	6·1	1227	4·4
10-in. B.L.R.	I., II.	30	329	6,779	251·1	25·1	510	90·0	2000	14,141	10·7	1590	8·0	1274	6·1	1103	5·0
10-in. B.L.R.	III.	40	413	10,222	327·0	34·6	510	207·5	2700	25,772	19·4	2184	11·9	1747	9·0	1406	6·9
12-in. B.L.R.	I., II.	35	441	11,991	345·2	45·3	870	160·0	2100	26,596	14·2	1733	11·2	1433	8·8	1219	7·2
12-in. B.L.R.	III., IV.	40	493	17,096	392·2	52·1	870	237·5	2400	34,738	19·8	1994	13·3	1649	10·5	1376	8·3
12-in. B.L.R.	III., IV.	40	493	17,096	392·2	52·1	870	305·0	2600	40,768	18·5	2171	14·8	1801	11·7	1500	9·3
12-in. B.L.R.	V.	45	553	16,974	452·0	52·9	870	305·0	2700	43,964	19·4	2259	15·5	1877	12·3	1561	9·8
12-in. B.L.R.	VI.	45	553	14,970	452·0	53·6	870	340·0	2850	48,984	20·8	2393	16·6	1991	13·3	1653	10·6
12-in. B.L.R.	VII.	50	607	14,296	506·3	56·1	870	340·0	2950	52,483	25·7	2483	17·5	2071	13·9	1719	11·0
13-in. B.L.R.	I., II.	35	479	15,068	374·9	61·4	1130	180·0	2000	31,333	15·0	1679	12·0	1414	9·7	1221	8·1
14-in. B.L.R.	I.[1]	45	642	..	..	63·6	1400	365·0	2600	65,606	28·3*	..	23·4*	..	..	..	..
14-in. B.L.R.	II.[2]	50	700	..	..	82·2	1400	..	2800	76,180	..	..	27·4	..	..	..	..

[1] Pennsylvania class. [2] New Mexico class. For the 16-in. gun see the Bethlehem table, *post*.

* Harveyized armour. † A short anti-aircraft 3-in. gun is mounted in many of the ships. ‡ There is now a 4-in. 50-cal. anti-aircraft gun.

§ All battleships from the Delaware class onward have this gun for torpedo defence.

Corrected to 1920.

ELSWICK B.L. AND Q.F. GUNS.

This Table is supplied by the Manufacturers.

	Automatic for Aircraft.				Semi-Automatic.			Semi-Auto-matic.	Non-recoil.		Naval Landing.	Balloon Attack.		Semi-Auto-matic.	Jointed Gun.		Semi-Auto-matic.	
Diameter of Bore ....ins.	1·457	1·457	0·9	1·85	1·85	1·85	2·24	2·24	2·24	2·953	3	3*	3	3	3	4	4	4·7
do. do. ....mm.	37	37	22·86	47	47	47	57	57	57	75	76	76	76	76	76	102	102	120
Length of Bore ....cals.	45	40	66	40	46	50	40	50	27	14·13	18·8	28	50	50	19·2	50	40	45
	lb.	lb.	lb.	cwts.	cwts.	cwts.	cwts.	cwts.	lb.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Weight of Gun	340	230	230	4·51	5·0	7·5	7·5	10·5	329	1·875	4	8	17·75	23	4·5	42	27	53
do. do. ....kilos.	154	104	104	230	254	381	381	533	149	95	203	406	901	1168	229	2134	1360	2692
do. Projectile ....lbs.	1·5	1·5	6 oz.	3·3	3·3	3·3	6	6	6	11·75	12·5	12·5	12·5	14·33	14·33	31	31	45
do. do. ......kilos.	0·681	0·681	0·17	1·5	1·5	1·5	2·722	2·722	2·72	5·33	5·67	5·67	5·67	6·5	6·5	14·06	14·06	20·41
	oz.	oz.	oz.	oz.	oz.	lb. oz.	oz.	lb. oz.	oz.	oz.	oz.	lb.	lb. oz.	lb.	ozs.	lb.	lb.	lb. oz.
do. Charge, M.D. Cordite	2¼	2¼	1¼	8·25	10·0	1 0	10	1 2·5	7¼	7·75	15	1·1	3 0	5·75	15	10·5	5·0	9 11
do. do. do. kilos.	0·071	0·071	0·042	0·234	0·283	0·453	0·283	0·525	0·22	0·22	0·369	0·5	1·36	2·608	0·425	4·76	2·27	4·395
Muzzle Velocity ....f.s.	2035	2000	2800	2132	2300	2680	1968	2400	1000	1100	1585	1640	2600	3050	1485	3000	2300	2600
do. do. ......m.s.	620	609	853	650	701	817	600	731	305	335	483	500	792	930	452	914	701	792
Muzzle Energy ....f.t.	43	41·6	20·4	104	121	164	161	240	41·6	98	213	233	586	922	218	1934	1137	2109
do. do. ....m.t.	13·3	12·8	6·3	32·2	37·5	50·8	49·8	74·3	12·8	30·3	66	72	181·5	285·5	67·5	599	352	653
Penetration at Muzzle ...ins. (Tressider Wrought Iron Pl.)	3·5	3·4	3·6	5·15	5·8	7·3	5.4	7·3	1·95	..	..	5·1	10·3	13 7	..	17·4	11·6	15·6
do. do. ...mm.	88·9	86·3	91·4	130·8	147·3	185·4	137·2	185·4	49·5	..	..	129·5	261·6	348·0	..	442·0	294·6	396·2
Rounds per Minute	70	70	80	25	30	30	25	30	..	20	20	20	20	25	15	12	20	12

Diameter of Bore ....ins.	4·7	5	5·5	6	6	7·5	7·5	8	8	9·2	9·2	10	10	12†	12†	13·5	14†	15	15
do. do. ....mm.	120	127·2	139·7	152	152	190	190	203	203	234	234	254	254	305	305	343	355·6	381	381
Length of Bore ....cals.	50	45	50	45	50	45	50	45	50	45	50	45	50	45	50	45	45	40	45
	cwts.	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
Weight of Gun	66	4·05	5·65	8·4	8·75	13·8	15·75	18·0	20·4	26·75	28·82	36·25	38·25	59·3	66·7	76	85	85	98·6
do. do. ....kilos.	3353	4114	5740	8535	8890	14021	16003	18289	20727	27179	29289	36832	38864	60252	67770	77216	86364	86364	96118
do. Projectile ....lbs.	45	60	83	100	100	200	200	250	250	380	380	500	500	850	850	1250	1400	1920	1925
do. do. ......kilos.	20·41	27·2	37·6	45·36	45·36	90·72	90·72	113·4	113·4	172·37	172·37	226·8	226·8	385·55	385·55	567	635	871	873·2
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
do. Charge, M.D. Cordite	14	16	25·0	31	33·0	74	76	80	90	122	136	167	200	260	285	296	324	380	400
do. do. do. kilos.	6 35	7·25	11·34	14·061	15·0	33·566	34·473	36 29	40·82	55·34	61·7	75·75	90·72	117·93	129·3	134·26	147	172·3	181
Muzzle Velocity ....f.s.	3000	2700	2900	2800	3000	2900	3000	2845	3000	2750	3000	2800	3000	2800	3000	2700	2700	2362	2500
do. do. ....m.s.	914	823	884	853	914	884	914	867	914	838	914	853	914	853	914	823	823	720	762
Muzzle Energy ....f.t.	2808	3032	4840	5436	6240	11663	12481	14031	15600	19926	23714	27181	31203	46208	53046	63187	70770	74275	83425
do. do. ....m.t.	869·6	939	1499	1683·4	1932	3611·9	3865·2	4345·2	4831·2	6171	7340	8418	9663	14310	16428	19568	21916	23002	25835
Penetration at Muzzle ...ins. (Tressider Wrought Iron Pl.)	19·3	18·4	25·8	22·9	25·5	30·6	32·3	32·2	34·9	35·2	40·1	39·7	44·1	47·3	52·5	51·3	53·2	49·1	53·7
do. do. ...mm.	490·2	724	701·0	581·6	647·7	777·2	820·4	817·9	886·4	894·1	1018·5	1008·4	1120·1	1201·4	1333·5	1303·0	1351·3	1247	1364
Rounds per Minute	12	10	10	9	9	6	6	5	5	4	4	3	3	2	2	2	2	2	2

Corrected to 1920.

* This gun can be arranged for anti-torpedo boat attack also.

† These guns can be used on Railway Truck Mountings.

ELSWICK HOWITZER, FIELD AND TRENCH GUNS.

This Table is supplied by the Manufacturers.

	Moun tain Gun.	Field.	Horse and Field.	Field.	Howitzers.			Field Position.	Howitzers.						Howtzr.	Bomb Thrower	Trench Howtzr.	Trench Howtzr.	Stick Bomb Thrower	Anti-Aircraft.	Tank.
Diameter of Bore ... ins.	2·953	3	3	3·3	4	4·3	4·7	5	5	6	8	9·2	11	11·24	12	13·5	11	5	3·5	3	2·244
„ „ ... mm.	75	76	76	84	102	109·2	120	127	127	152	203	234	279·4	285·5	304·8	342·9	279·4	127	88·9	76·2	57
Length of Bore ... calibres	15·2	28	23	28	8·75	12·5	12	32	8·4	12·2	12	13·7	12	15	17·3	..	5	5·4	..	45	23
	lb.	cwt.	cwt.	cwt.	lb.	cwt.	cwt.	tons	cwt.	ton	tons	tons	tons	tons	tons.	lb.	lb.	lb.	lb.	cwt.	cwt.
Weight of Gun	260	7·25	6	9	220	7	8	2	9	1	2·6	4·3	5·5	7·85	10·5	973	1481	252	863	20	5
„ „ ... kilos.	118	368	305	457	100	356	406	2032	457	1016	2642	4369	5588	7976	10,668	441	672	114	391	1016	254
„ Projectile lbs.	12·5	14·3	12·5	18·5	20	40	35	60	50	100	240	290	500	661·38	750	200	200	40	200	12·5	6
„ „ kilos.	5·67	6·49	5·67	8·39	9·07	18·14	15·87	27·22	22·68	45·36	108·9	131·5	227	300	340·2	90·7	90·7	18	90·7	5·6	2·722
	oz.	oz.	lb. oz.	lb. oz.	oz.	oz.	lb. oz.	lb. oz.	oz.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	oz.	lb. oz.	lb. oz.	oz.
„ Charge M.D. Cordite	10	20½	1 4	1 6	8½	16¼	1 4½	9 8	12	3	7·5	14	20	32	49	1¼	1	3½	2 10	2 10	8¾
„ „ „ kilos.	0·283	0·582	0·567	0·624	0·241	0·461	0·582	4·31	0·34	1·361	3·4	6·35	9·07	14·51	22·2	·6	454	·1	1·2	1·2	·248
Muzzle Velocity ... ... f.s.	1250	1755	1700	1635	950	980	1150	2150	782	1000	1000	1250	1220	1230	1470	380	400	429	355	2575	1580
„ „ ... m.s.	381	535	518	498	290	298	350	655	238	305	305	381	372	375	448	115·8	122	130·7	108·2	784·8	481·5
Muzzle Energy ....f.t.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11,238	200	222	51	174·7	574·7	103·9
do. do. ....m.t.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3480	61·9	68·7	15·8	54·1	178	32·2
Penetration at Muzzle ...ins. (Tessider Wrought Iron Pl.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16·9	..	..	..	..	10·1	3·9
do. do. mm	..	..	..	..	..	..	..	..	..	..	..	..	..	..	429·2	..	..	..	..	256·5	99
Rounds per Minute............	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	20	25

Corrected to 1920.

VICKERS' GUNS AND MOUNTINGS.

This Table is supplied by the Manufacturers.

		37 m/m Auto.	37 m/m Auto.	40 m/m Auto.	3-pdr. Semi-Auto.	6-pdr. Semi-Auto.	3-in. Semi-Auto.	4-in. Semi-Auto.	4-in. Semi-Auto.	4-in. B.L.	4·7-in. B.L.	4·7-in. B.L.	4·7-in. Q.F. Naval Howitzer.	5·118-in. B.L.	6-in. B.L.	6-in. B.L.	6-in. Semi-Auto.
		30 cal.	42·5 cal.	40 cal.	50 cal.	50 cal.	50 cal.	40 cal.	45 cal.	50 cal.	45 cal.	48·5 cal.	18 cal.	54 cal.	45 cal.	50 cal.	50 cal.
Construction . . .	ins.	S.	S.	S.	S.	S.	S.	S. & W.	S.& W.	S. & W.	S.& W.	S.	S.	S.	S. & W.	S. & W.	S. & W.
Diameter of Bore . .	ins.	1·457	1·457	1·575	1·85	2·244	3	4	4	4	4·724	4·724	4·724	5·118	6	6	6
Length of Bore . .	ins.	43·5	62	62	92·5	112·2	150	160	180	201·15	212·6	228·45	85	276·37	269·5	300	300
Length of Gun . .	ins.	73·75	94	95·7	98·9	118·6	157	166·6	187·8	208·45	220	236·2	89·9	281·5	279 228	310·07	311·17
		lb.	lb.	lb.	cwt.	c. q.	cwt.	cwt.	cwt.	cwt.	t. c.	t. c.	c. q.	t. c. q.	t. c. q.	tons	t. c.
Weight of Gun		432	551	616	6	9 1	19	25	43	42	3 4	3 2	11 1½	5 3 2	7 8 2	8	8 19
Weight of Projectile . .	lb.	1	1·5	2	3·3	6	12·5	31	31	31	45	45·14	45	81·26	100	100	100
Muzzle Velocity . . .	f.s.	1800	2100	2000	2800	2600	2700	2300	2700	3030	2800	3050	1200	2700	2900	3100	2900
Muzzle Energy . . .	f.t.	22·5	46	55·5	180	280	630	1135	1565	1975	2445	2910	450	4110	5830	6665	5830
Penetration of Wrought Iron Plate at Muzzle, Gavre formula. Uncapped Projectiles	ins.	..	..	..	6·7	7·5	9·65	10·8	13·6	16	15·9	17·8	..	20·8	22·6	24·8	22·6
Rounds per minute . . .		200	200	200	30	28	25	20	18	15	12	12	10	10	10	10	8
Weight of Mounting complete with Shield . . .		lb. 800	lb. 800	lb. 1000	c. q. lb. 11 2 5	c. q. lb. 17 3 10	t. c. q. lb. 1 3 1 10	t. c. q. lb. 2 9 2 21	t. c. q. 2 18 3	t. c. q. lb. 3 5 0 27	t. c. q. 3 15 0	t. c. q. lb. 5 9 1 21	t. c. q. lb. 4 1 2 11	t. c. q. l. 12 9 3 13	t. c. q. lb. 12 9 2 3	t. c. q. 14 17 2	t. c. q. lb. 12 0 1 24
Weight of shield		..	..	..	1 0 20	1 2 10	2 0 14	7 2 0	7 2	14 1 13	15 2	1 12 2 0	2 0 0 4	4 4 3 16	4 4 3 16	6 5 0	5 5 1 15
Thickness of Shield .	ins.	..	..	..	·22	·25	·25	·144	·144	·25	·25	3	1·9	1·5 & 1	1·5 & 1	4 to 1·2	3 to 1·2
Angle of Elevation .	deg.	80	80	80	20	20	20	30	30	30	30	30	70	30	30	30	15
Angle of Depression .	deg.	10	10	5	10	10	10	10	10	10	10	10	5	5	5	7	7

		8-in. B.L.	9·2-in. B.L.	9·2-in. B.L.	10-in. B.L.	10-in. B.L.	11-in.B.L. Naval Howitzer.	12-in. B.L.	12-in. B.L.	13·5-in. B.L.	14-in. B.L.	14-in. B.L.	15-in. B.L.	15-in. B.L.	16-in. B.L.	16-in. B.L.	16-in. B.L.
		48·52 cal.	45 cal.	50 cal.	45 cal.	48·6 cal.	8 cal.	45 cal.	50 cal.	45 cal.	45 cal.	50·42 cal.	40 cal.	45 cal.	40 cal.	43·65 cal.	45 cal.
Construction		S.	S. & W.	S. & W.	S. & W.	S.	S.	S. & W.	S. & W.	S. & W.	S. & W.	S.	S. & W.	S. & W.	S. & W.	S.	S. & W.
Diameter of Bore . .	ins.	8	9·2	9·2	10	10	11	12	12	13·5	14	14	15	15	16	16	16
Length of Bore . .	ins.	388·2	414	461·4	450	486	88	540	600	607·5	630	705·88	600	675	640	698·45	720
Length of Gun . .	ins.	400	427·03	474·4	464·6	500	96·6	557·55	617·7	625·9	648·4	728	620·3	695·3	661·25	720	741·25
		t. c. q.	t. c. q.	t. c. q.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c. q.	t. c.	tons	t. c.	tons	tons	t. c.	tons
Weight of Gun		14 3 1	26 11 3	28 6 2	34 17	27 17	1 18	57 14	66 14	76 12 1	83 9	82	82 10	97	100	107 14	117
Weight of Projectile . .	lb.	247·4	380	380	500	496·6	350	850	850	1400	1488	1648	1900	1900	2240	2461·2	2240
Muzzle Velocity . . .	f.s.	3000	2800	2900	2780	2863	585	2850	3010	2500	2525	2700	2350	2500	2350	2500	2450
Muzzle Energy . . .	f.t.	15440	20660	22160	26800	28225	682	47875	53400	60675	65790	83305	72750	82340	85780	106665	93230
Penetration of Wrought Iron Plate at Muzzle. Gavre Formula. Uncapped Projectile .	ins.	33·2	35·3	37	38·9	40·2	—	48·3	52·1	50	51·5	60·7	51	56	54	63	57
Rounds per minute . . .		6	4	4	3	3	4	2	2	1·5	1·35	1·35	1·2	1·2	1·2	1·2	1·2

VICKERS' GUNS AND MOUNTINGS.

AIRCRAFT AND ANTI-AIRCRAFT GUNS.

		AIRCRAFT.									ANTI-AIRCRAFT.							
—		·303-in. Auto.	·5-in. Auto.	1-in. Auto.	37 m/m. 1-pdr. Auto.	40 m/m. 2-pdr. Auto.	37 m/m. Semi-Auto.	40 m/m. Q.F.	40 m/m. Semi-Auto.	6-pdr. Q.F.	37 m/m. 1-pdr. Auto.	37 m/m. 1·5-pdr. Auto.	40 m/m. 2-pdr. Auto.	3-pdr. Semi-Auto.	3-in. Q.F.	3·3-in. Q.F.	4-in. Q.F.	4-in. B.L.
		93·7 cal.	60 cal.	30 cal.	22 cal.	42·5 cal.	26·1 cal.	25·1 cal.	40 cal.	25 cal.	30 cal.	42·5 cal.	40 cal.	50 cal.	45 cal.	50 cals.	45 cal.	50 cal.
Construction		S.	S.	S.	S.	S.	S.	S.	S.	S.	S.	S.	S.	S.	S. & W.	S. & W.	S. & W.	S. & W.
Diameter of Bore . .	ins.	·303	·5	1	1·457	1·575	1·457	1·575	1·575	2·244	1·457	1·457	1·575	1·85	3	3·3	4	4
Length of Bore . .	,,	28·4	30	30	32·05	62	38·06	39·56	63	56·1	43·5	62	62	92·5	135	165	180	200
Length of Gun . .	,,	41·3	46·5	55	59·7	108	40·25	41·75	65·25	59·5	73·75	94	95·7	98·9	140·25	170·3	187·8	208·45
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	cwt.	c. q.	t. c. q.	t. c.	t. c. q.
Weight of Gun		30	50	110	130	400	110	132	234	284	432	551	616	6	18 3	1 13 2	1 18	2 1 3
Weight of Projectile .	. lb.	174 grs.	570 grs.	·441	1	2	1·5	2	2	6	1	1·5	2	3·3	12·5	21	31	31
Muzzle Velocity . .	. f.s.	2400	2600	1542	1200	2000	1200	1200	2300	1200	1800	2100	2000	2800	2600	2400	2700	3030
Muzzle Energy . .	. f.t	1	3·8	7·25	10	55·5	15	20	73	60	22·5	46	55·5	180	585	840	1565	1975
Rounds per minute . . .		500 to 1000	300 to 1000	200	150	100	—	—	—	—	200	200	200	30	25	20	18	15
			lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	c. q. l.	t. c. q. l.	t. c. q. l.	—	t. c. q. l.
Weight of Mounting . . .		—	25	65	100	140	333	130	432	185	800	800	1000	18 2 3	2 8 3 0	4 8 2 23	—	3 7 2 0
Angle of Elevation .	deg.	—	80	40	60	72	30	70	60	60	80	80	80	80	85	85	—	80
Angle of Depression .	,,	—	30	90	60	30	30	40	30	90	10	10	5	5	10	0	—	5

HOWITZERS, FIELD, MOUNTAIN AND LANDING GUNS.

		HOWITZERS.				FIELD.					MOUNTAIN.		LANDING.
		6-in. B.L.	8-in. B.L.	9·2-in. B.L.	12-in. B.L.	3-in. Q.F.	3-in. Q.F.	3·3-in. Q.F.	5-in. B.L.	6-in. B.L.	75-mm. Q.F.	3-in. Q.F.	3-in. Q.F.
		21 cal.	17·3 cal.	17·3 cal.	17·3 dal.	22·9 cal.	33·2 cal.	28·1 cal.	37 cal.	35 cal.	17 cal.	14·3 cal.	22 cal.
Construction		S. & W.	S. & W.	S. & W.	S. & W.	S. & W.	S.	S. & W.	S. & W.	S. & W.	S.	S.	S.
Diameter of Bore .	ins.	6	8	9·2	12	3	3	3·3	5	6	2·953	3	3
Length of Bore .	ins.	126	138·4	159·16	207·6	68·7	99·5	92·735	185	210	50·2	42·94	66
Length of Gun .	ins.	134·15	148·3	170·51	222·35	73·26	103·8	96·96	192·25	219·22	53·85	47·28	70·34
		t. c. q.	t. c.	t. c. q.	t. c. q.	c. q.	c. q.	c. q.	t. c. q.	t. c. q.	c. q. l.	c. q. l.	c. q. l.
Weight of Gun . . .		1 19 2	3 7	4 5 2	9 2 2	6 0	7 2	8 2	2 3 1	4 11 2	3 3 10	2 2 4	3 3 4
Weight of Projectile	lb.	86	200	290	750	15	14·33	18 5	60	100	14·33	12·5	12·5
Muzzle Velocity .	f.s.	1760	1520	1520	1520	1480	1660	1650	2200	2400	1312	1150	1640
Muzzle Energy .	f.t.	1845	3205	4645	12015	228	274	350	2015	3995	171	115	233
Rounds per minute . .		3	2	2	1	25	25	20	4	3	15	15	25
		t. c. q.	t. c	t. c.	t. c.	c. q. l.	c. q. l.	c. q. l.	t. c. q.	t. c. q.	c. q. l.	c. q. l.	c. q. l.
Weight of Mounting complete with Shield .		2 16 2	5 14	11 5	36 10	14 2 14	14 0 0	19 2 0	2 17 0	5 12 0	10 1 0	7 1 0	9 2 0
Weight of Shield . . .		—	—	—	—	1 2 0	1 0 15	1 3 0	—	—	1 1 0	2 17	1 1 15
Thickness of Shield	ins.	—	—	—	—	·125	·144	·125	—	—	·125	·125	·192
Angle of Elevation	deg.	42	45	50	65	30	16	37·5	42	38	50	25	23
Angle of Depression	deg.	0	0	0	0	5	10	5	0	0	10	15	10

Corrected to 1920.

BEARDMORE GUNS.

This Table is supplied by the Manufacturers.

(November, 1920.)

Gun Calibre.	Length of Bore.	Weight of Gun.		Weight of Shot.	Muzzle Velocity.
inches.	calibres.	tons.	cwts.	lbs.	ft.-secs.
15·0	42·0	90	0	1850	2550
13·5	46·0	77	0	1375	2620
12·0	50·0	66	0	950	2820
9·2	50·0	28	10	425	2810
7·5	45·0	13	18	200	2800
6·0	50·0	8	14	100	2950
6·0	45·0	6	18	100	2800
5·0	50·0	4	6	60	2950
4·7	45·0	3	4	45	2750
4·0	50·0	2	8	31	3000
4·0	45·0	2	2	31	2800
3·3	29·5	0	9	185	1700
3·0	40·0	0	12	125	2250
2·24	23·2	0	5	6	1525
Auto-Aircraft Gun. 1·45	19·0	lbs. 95		1	1400

BETHLEHEM STEEL CO.

ORDNANCE.

Table supplied by the Manufacturers, 1920.

Calibre.	Length of bore in Calibres.	Calibre.	Weight of Gun.	Weight of Projectile.	At Muzzle.		Penetration of Wrought Iron. (Gavre Formulæ.)	At 3000 yards Range.			At 8000 yards Range.			Limiting ranges beyond which capped armour piercing projectiles will not penetrate hard-faced armour of 12 inches and 7 inches thickness. (Davis Formula.)		Calibre.
					Velocity.	Energy.		Dangerous Space for Target 25 feet high.	Energy.	Penetration of Krupp hard-faced armour by capped armour piercing projectiles, with normal impact. (Davis Formula.)	Dangerous Space for Target 25 feet high.	Energy.	Penetration of hard-faced armour by capped armour piercing projectiles, with normal impact. (Davis Formula.)	12-in. plate.	7-in. plate.	
inches.	calibres.	cms.	lbs.	lbs.	ft. per sec.	foot-tons.	inches.	yards.	foot-tons.	inches.	yards.	foot-tons.	inches.	yards	yards.	inches.
1 457	50	3·7	160	1	2150	32	..	..	..	..	..	..	..	..	..	1·457
1·851	50	4·7	550	3	2400	120	..	..	..	..	..	..	..	..	..	1·851
2·244	50	5·7	960	6	2400	240	..	..	..	..	..	..	..	..	..	2·244
3	50	7·62	1900	13	2800	707	..	..	..	..	..	..	..	..	..	3
4	50	10·16	tons. 2·6	33	2800	1,793	11·0	320	890	..	..	..	..	..	..	4
4	50	10·16	2·6	kilos. 14	3000	1,924	11·5	362	980	..	..	..	..	..	..	4
5	45	12·7	3·4	lbs. 50	2600	2,343	11·3	253	1,096	..	..	..	..	..	..	5
5	50	12·7	4·75	50	3000	3,120	13·8	371	1,514	..	..	..	..	..	..	5
6	45	15·24	7·2	105	2600	4,920	16·9	313	2,970	7·0	60	1,307	4·2	..	2,870	6
6	50	15·24	8·4	105	2800	5,707	18·8	374	3,478	7·7	71	1,543	4·6	..	3,890	6
7	45	17·78	12·7	165	2700	8,338	22·0	358	5,426	9·2	74	2,660	5·9	..	6,063	7
7	50	17·78	14·5	165	2900	9,619	24·4	422	6,263	10·1	87	3,130	6·5	..	7,063	7
8	45	20·32	18·6	260	2800	14,460	29·2	410	9,869	12·3	92	5,457	8·5	3,240	10,420	8
8	50	20·32	22·3	260	2900	15,160	30·7	441	10,616	12·9	100	5,885	8·9	3,950	11,235	8
9·2	50	23·37	30·4	380	2900	22,200	35·8	450	15,760	14·9	107	9,350	10·8	7,237	15,311	9·2
10	45	25·4	35·4	515	2800	27,990	40·5	429	21,080	17·2	106	13,160	12·8	9,075	Over 16,000	10
10	50	25·4	43·9	515	2900	30,020	42·6	453	22,671	18·0	114	14,394	13·6	10,000	,,	10
12	45	30·48	53·8	870	2800	47,380	51·8	439	36,794	21·7	114	24,608	16·9	14,560	,,	12
12	50	30·48	66·0	870	2900	50,720	54·4	476	39,990	23·0	123	26,495	17·7	15,596	,,	12
14	35	35·56	57·4	1660	2150	53,190	50·4	244	44,660	22·3	70	33,650	18·7	Over 16,000	,,	14
14	45	35·56	70·3	1400	2600	65,700	56·4	362	50,420	24·0	98	39,840	20·7	,,	,,	14
14*	50	35·56	82·2	1400	2800	76,180	62·0	471	62,100	27·4	117	43,590	21·9	,,	,,	14
15	45	38·1	90·0	1700	2600	79,760	64·1	390	65,330	27·0	100	46,300	21·8	,,	,,	15
16	45	40·64	96·0	2100	2500	91,110	67·3	400	75,700	28·5	94	61,130	23·3	,,	,,	16
18	30	45·72	60·0	2075	2150	66,490	49·4	235	52,750	21·1	63	36,365	16·7	15,100	,,	18

Guns of 3-in. calibre or under are chambered for fixed ammunition with the powder and projectiles in brass cartridge cases. Guns from 3-in. calibre upwards, and including the 6-in. L-45 gun, can be chambered to use either fixed ammunition, or chambered to use loose ammunition with the powder in cartridge bags and the projectile separate from the powder. Guns above 6-in. calibre and including the 6-in. L-45 gun are chambered for loose ammunition. The breech mechanisms of all guns up to 8 in. are operated by the single motion of a hand-lever. **In addition to the 18-in. calibre guns there are 30-calibre 14-in. and 16-in. guns.**

*** This is the gun to be mounted in the battleships New Mexico, Idaho and Mississippi.**

GERMAN SHIP AND COAST GUNS (KRUPP).

[These guns, as well as some shorter and smaller guns, were included in the latest available German official table.]

Calibre	cm.	8·8 = 3·4 in.	10·5 = 4·1 in.	15 = 5·9 in.		17 = 6·7 in.	21 = 8·2 in.			24 = 9·4 in.	
Length of Bore	cals.	40	40	40	45	40	40	45	50	40	
Length of Bore . . .	mm.	3520	4200	5965	6710	6905	8370	9420	10465	9600	
Total Length	,,	3750	4475	6355	7100	7355	8915	9965	11010	10225	
Weight of Gun	kg.	1094	1555	4460	5020	6930	12330	13900	15450	18600	16750
Weight of Projectile . .	,,	9·5	16	46	46	70	125	125	125	190	190
Weight of Charge . . .	,,	2·66	5·05	14·4	16·6	22·4	39·9	45·8	52·3	60·1	51·8
Muzzle Velocity	m.	840	840	840	890	840	840	890	940	840	800
Muzzle Energy . .	mètre-tons	341·7	575	1654	1857	2517	4495	5047	5629	6833	6198
Muzzle Penetration (Steel)	mm.	243	292	426	463	492	606	658	711	703	658

Calibre	cm.	28 = 11 in.						30·5 = 12 in.				38·1 = 15 in.	
Length of Bore	cals.	40		45		50		45		50		45	
Length of Bore	mm.	11200		12600		14000		13725		15250		17145	
Total Length	,,	11930		13330		14730		14520		16045		18135	
Weight of Gun	kg.	29550	26600	33300	30200	37000	34050	43000	39000	47800	44000	83800	76100
Weight of Projectile . . .	,,	300	300	300	300	300	300	390	390	390	390	760	760
Weight of Charge	,,	95	82	110	95	125	111	142	123	162	143	277	241
Muzzle Velocity	m.	840	800	890	850	940	900	890	850	940	900	890	850
Muzzle Energy . .	**mètre-tons**	10790	9790	12110	11050	13510	12390	15750	14360	17560	16100	30680	27990
Muzzle Penetration (Steel) .	**mm.**	828	772	900	842	973	914	990	927	1071	1006	1257	1177

SIZE AND FIGHTING QUALITIES OF BRITISH BATTLESHIPS OF DIFFERENT PERIODS.

Name.	Date of Completion.	Displacement.	Side Armour.	Speed.	Total Weight of Shot in One Round.	Collective Energy at Muzzle of One Round.
		tons.	in.	knots.	lb.	foot-tons.
Warrior	1861	9,210	4½-in. wrought-iron	14½	3,800	61,476
Hercules	1868	8,680	9-in. to 6-in. wrought-iron	14	5,400	70,200
Alexandra	1877	9,490	12-in. to 6-in. wrought-iron	15	5,426	71,400
Inflexible	1881	11,880	24-in. to 16-in. wrought-iron	13	6,936	123,120
Benbow	1888	10,600	18-in. compound	16·75	4,600	135,560
Royal Sovereign	1892	14,150	18-in. and 5 in. compound	17·5	5,800	159,610
Barfleur	1894	10,500	12-in. compound	18·5	2,450	67,670
Canopus	1900	12,950	6-in. hardened steel	18·25	4,600	178,720
Prince of Wales	1902	15,000	9-in. super-hardened steel	18·25	4,600	194,400
King Edward VII.	1905	16,350	9-in. hardened steel	19	6,100	271,800
Dreadnought	1906	17,900	11-in. hardened steel	21	8,800	487,100
Neptune	1911	20,600	12-in. hardened steel	21·5	8,900	545,000
Ajax	1913	25,000	12-in. hardened steel	21·5	14,500	625,000
Queen Elizabeth	1914	27,500	13-in. hardened steel	25	{ about 16,400 }	710,000

PARTICULARS OF SUCCESSIVE LARGE BRITISH NAVAL GUNS, 1800 TO 1920.

Year.	Type.	Weight.		Length.	Calibre.	Weight of Projectile.	Weight of Charge.	Muzzle Energy.	Penetration of Wrought-iron at 1000 yards range.
		tons.	cwt.	in.	in.	lb.	lb.	ft.-tons.	in.
1800	Cast-iron smooth-bore	2	12	114	6·4	32	10	400	—
1842	Ditto	4	15	—	8·12	68	16	700	—
1865	Woolwich wrought-iron	4	10	—	7	115	22	1,400	7
1870	Built-up muzzle-loader	38	0	200	12·50	810	200	13,900	17
1880	Ditto	80	0	321	16	1700	450	27,960	22½
1887	Built-up breech-loader	110	10	524	16·25	1800	960	54,390	32
1895	Wire-wound breech-loader	46	0	445·5	12	850	—	33,940	34·6
1900	Ditto	51	0	496·5	12	850	210	36,290	35·4
1905	Ditto	58	0	558	12	850	—	47,700	46·2
1912	Ditto	76	0	626	13·5	1400	—	60,600	*50
1914 to 1920	Ditto	97	0	675	15	1900	—	82,300	*56

* At muzzle. Guns of 18-in. calibre were fitted to one cruiser during the War, but were subsequently removed and used in monitors.

MESSRS. THORNYCROFT'S BOMB THROWERS.

The Editors regret that in this section of the "Annual" of 1919, in reviewing the armament work done during the war, full credit was not given to Messrs. John I. Thornycroft & Co., Ltd., for the work they did in connection with bomb throwers. Early in the war they found that the 9·45″ bomb thrower, which the English Army was using, was unsatisfactory, and they carried out a long series of experiments. The pressure in the gun barrel for a short range was so low that the cordite could not be relied upon to burn uniformly. They therefore arranged to burn the cordite in a separate vessel at a higher pressure, so that uniform combustion could be obtained. The gases from the separate vessel passed into the barrel of the gun through a comparatively small vent, so that while the pressure was reduced it gave about 1500 yards range. The firm evolved this method of burning cordite to operate torpedo discharge gear in the coastal motor boats designed and built by them. In their case the high-pressure gases were used instead of compressed air to operate a discharging ram. Eventually this design was adopted, and a large number of bomb throwers were put in hand. The firm also used this mechanism for throwing 300-lb. depth charges. The first batch of these bomb throwers was made of steel, but, owing to the shortage of this material, cast-iron was adopted, with the consequence that the rate of production was very largely increased. The Admiralty specially conveyed to Messrs. Thornycroft "an expression of their appreciation for the able production of so valuable a weapon."

FIRST LORD'S STATEMENT EXPLANATORY OF THE NAVY ESTIMATES, 1919-1920.

THE Navy Estimates for 1919-20 as now presented to the House of Commons amount to a net sum of £157,528,800.

This amount exceeds the forecast of £149,200,000 shown in the White Paper presented last March by £8,328,800.

As was pointed out to the House of Commons at the time, the forecast made in March, although the best that could be made in the circumstances actually existing, was not in any sense a detailed estimate, the data for preparing which were not then available.

Since March additional items of expenditure—some of which could not be foreseen, whilst others, such as the improvement in pay for the personnel of the Navy, were foreseen, but could not be estimated for—have matured for inclusion in these Estimates.

The chief of these items are as follow:—

	£
Additional pay and pensions for the officers of the Fleet . . .	2,400,000
Additional pay and pensions for the men of the Fleet	8,000,000
Increase in rates of war gratuities and extension to mercantile officers employed in the Naval Service	3,000,000
Transfer to Navy Votes of expenditure on account of hire of vessels for naval purposes and freight of fuel and stores, which during the war was borne by the Ministry of Shipping . . .	6,500,000
Extra provision required for reconditioning of hired vessels . .	2,750,000
Special requirements of fuel, etc., owing to the presence of the Fleet in Russian waters and Eastern Mediterranean . . .	4,250,000

The total of the additional items of expenditure was slightly over £27,000,000.

On the other hand, the progress of the peace negotiations and the consequent ascertainment of many factors that were quite uncertain last March, and further, the close review which the Admiralty have since made of all services and expenditure, have made it possible to set off a reduction of £19,000,000 against the additional items referred to. This reduction is accounted for to the extent of £9,000,000 by increased appropriations in aid, chiefly in respect of receipts from the Allies for fuel supplies and the sale of stocks of coal owing to the withdrawal of coal burning ships from the Navy. The resulting increase of £8,328,800 would have been less by about £3,000,000 but for the decision that the proceeds of the sale of surplus naval war property dealt with by the Disposals Board should be credited to the Ministry of Munitions and not to the Admiralty.

In considering these Estimates, it should be remembered, in the first place, that their amount bears little relation to the requirements of the Navy for the current year. A large proportion of the sum required is to pay for work done and services rendered prior to the Armistice, for work put in hand before the Armistice and so far carried out that it was not economical for it to be cancelled, for war gratuities on demobilisation, for the pay and victualling of surplus personnel, and for other purely dead-weight war expenditure. No comparison can therefore profitably be made between the total figure and that of the pre-war Estimates. Moreover, even if it were possible to disentangle the "normal" or "peace" expenditure, any such comparison would still be entirely fallacious until due allowance had been made for the fact that material and services cost roughly twice what they did before the war.

In the second place, it should be borne in mind that the conclusion of the Armistice, so far from finding the war effort of the nation on the decline, found us at the height of our endeavour to win the war, and with every kind of production and activity to that end at its maximum. That this was so in the case of the Naval effort will be seen from the following figures giving the actual expenditure during the (complete) war years:—

	£
1915-16	205,733,597 net
1916-17	209,877,218 net
1917-18	227,388,891 net
1918-19	325,000,000 (estimated).

Even these enormous figures, however, do not indicate fully the steep curve at the height of which we stood in November, 1918. The weekly rate of expenditure on the Navy at the time of the Armistice was actually about £6,750,000, or at the rate of more than £350,000,000 a year.

I append a summary of naval activities since the Armistice, and also some statistical tables illustrating the size of the naval forces employed during the war and the provision which had to be made for their upkeep.

WALTER H. LONG.

Admiralty,
1st December, 1919.

(NOTE.—The work of the Fleet after the Armistice is summarised in Chapter I., under Post-War Activities.)

NUMBERS BORNE IN H.M. FLEET.

——	15th July, 1914.	15th August, 1914.	15th November, 1918.
Royal Navy, Royal Marines, etc. (other than Retired, Pensioners, or Reserves)	146,047	147,667	188,537
Entered for hostilities only	—	—	74,437
Retired Officers and Pensioners . . .	—	6,970	12,346
Royal Fleet Reserve	—	27,395	19,180
Royal Naval Reserve	—	13,510	23,453
Royal Naval Reserve (Trawler Section) .	—	3,130	37,145
Royal Naval Volunteer Reserve . . .	—	2,345	50,218
Colonial Reserves	—	—	2,000
Total	146,047*	201,017*	407,316†

* R.N.A.S. included. † R.N. Division included, but M.M. Reserve excluded.

CASUALTIES IN THE ROYAL NAVY (EXCLUDING R.N. DIVISION, BUT INCLUDING R.N. AIR SERVICE TO 31ST MARCH, 1918) FROM 4TH AUGUST, 1914, TO 11TH NOVEMBER, 1918.

——	Officers.	Men.	Total.
Killed in action (including died of wounds)	2,059	20,148	22,207
Died from other causes	394	10,926	11,320
Wounded in action	805	4,072	4,877
Wounded, not in action	Nil	313	313
Prisoners of war	179	726	905
Interned	44	227	271
Missing	15	32	47
	3,496	36,444	39,940

FIRST LORD'S STATEMENT EXPLANATORY OF NAVY ESTIMATES, 1920–1921.

The Estimates for 1920–21 amount to £84,372,300, as compared with 1919–20 Estimates, together with the Supplementary Estimate, amounting to £157,528,810.

This total provides for—

(*a*) the liquidation of the terminal expenses of the war, which consist of expenditure already incurred, or to which the Admiralty are committed; estimated at £19,077,000;

(*b*) separation allowances; estimated to cost £3,915,000;

(*c*) expenditure of abnormal or quasi-war character arising out of temporary obligations, such as the maintenance of an adequate force in the Eastern Mediterranean and the Black Sea until peaceful conditions are re-established in those regions; estimated to cost about £500,000; and

(*d*) the maintenance during the coming year of a Fleet of the minimum strength which, in the opinion of the Board of Admiralty, can be regarded as providing in present circumstances for the security of the Empire.

Owing to the great increase of salaries, pay, wages and pensions, and in the prices of materials of every description since 1914, a direct comparison with the pre-war Estimates is of little value. An analysis, however, of the *gross* expenditure of £96,490,181 estimated to be incurred in 1920–21, shows that it can be approximately divided into—

	£
(*a*) Non-recurrent war liabilities or terminal charges	19,077,000
(*b*) Recurrent expenditure due to war conditions, *e.g.*, increases in prices and in rates of wages, pensions, etc., and separation allowance	40,023,200
(*c*) Normal expenditure on basis of pre-war rates and prices	37,489,981

On this basis, the following comparison of the *gross* estimate for 1914–15 with the *gross* estimate for 1920–21 can be made:—

1914–1915.	£	1920–1921.	£	£
Gross Estimate . . .	53,573,261	Gross Estimate		96,590,181
Deduct amount included for New Construction	18,373,000	*Deduct* War Liabilities including New Construction	19,077,000	
		Deduct Recurrent Expenditure due to war conditions . . .	40,023,200	59,100,200
	£35,200,261			£37,489,981

The increase of approximately £2,290,000 over the provision required in 1914–15 is due mainly to the following causes:—

The grant of Clothing Allowances to men of the Fleet.
Provision of larger Hospital Ships.
The extension of scientific research and of technical training.
Reduction in the hours worked by the Industrial Staff.
Increase in non-effective charges.

The above comparison takes no account of the greater extent to which stocks will be used without replacement during 1920–21 as compared with 1914–15. Against this, however, must be set the fact that a considerable expenditure will be incurred in 1920–21 in building up reserves of victualling and clothing stores, medical stores, oil fuel, and in the provision of new types of shell and ammunition consequent on experience gained in the early part of the war.

The number that we propose shall be voted in Vote A. for the maximum number of the Personnel of the Fleet to be borne on any day during the financial year, is 136,000, as compared with 151,000 in 1914–15. The numbers at the date of the Armistice were 407,316, and by November, 1919, had been reduced to 157,000. The actual number required for the reduced Fleet which it is proposed to maintain during the year is 127,500; but the provision under Vote 1 for the pay of the Fleet has been based on the assumption that 131,000 officers and men will still be borne at the end of the year, as it cannot be expected that all those who are surplus to our reduced requirements can be disposed of during 1920–21.

There is great difficulty in suddenly effecting large decreases or increases in naval personnel, and the reduction of over 25,000 officers and men in the 17 months from last November to April, 1921, will, if accomplished as we hope, be a remarkable feat. It must be remembered that the crew of a ship is made up of numerous small groups of individuals of many trades—Gunnery ratings, Torpedo ratings, Engine-room ratings, Signal ratings, Electricians, Armourers, Mechanics of many kinds, and so on, each group possessing entirely distinct qualifications and having an entirely distinct duty, but each absolutely essential to the fighting efficiency of the ship. In every adjustment of naval personnel, provision has to be made for each of these numerous branches of skilled men to be kept up to strength in every ship all over the world; any attempt to wash out naval personnel with a broad brush at once immobilises far more units of the Fleet than was ever intended.

The time is opportune for an explanation of some of the principal decisions which the Board of Admiralty have taken, and of the motives by which they have been guided, while framing these Estimates which may perhaps be described (in spite of the considerable provision for war commitments which they embody) as the first of the new series of Peace Estimates. I therefore append some notes on Naval Policy, and a note on Dockyard Policy.[1] It should be understood that these statements do not purport to be exhaustive even of the decisions already taken, still less of the matters which are engaging the attention of the Board.

The statement which I issued on 1st December last to accompany the Estimates for 1919–20 (Cd. 451) contained a Summary of naval activities since the Armistice. I have thought it unnecessary to present any detailed record of the work of the Navy and Admiralty during the short period which has since elapsed.

WALTER H. LONG.

ADMIRALTY,
12th March, 1920.

NOTES ON NAVAL POLICY.

(a) *General Remarks.*

1. During the past year it has not been possible to frame a definite statement on Naval Policy owing to the changing situation, the necessity for keeping the Fleet prepared for eventualities during the Armistice period, and the active operations imposed on the Navy in the Baltic.

2. It is now possible to estimate more clearly and closely what are the requirements of the future, and to make what it is hoped will be regarded as a fairly full statement of our naval commitments and proposals.

3. Since sea power is essential for the security and prosperity of the British Empire, it is the object of the Board of Admiralty to proceed on lines which they believe will provide us with our vital requirements, and at the same time secure the exercise of rigid economy. The expenditure necessary for such a policy is merely an insurance for our existence, and a guarantee of our increased prosperity.

4. In view of the vast efforts made during the years of war, it is possible for us to-day to suspend production for the time being and concentrate largely on assimilating the lessons of the war, the Fleet being reduced to minimum requirements as regards both personnel and matériel.

5. In the first place we have certain definite duties to perform in support of Allied Policy, and to assist in stabilising the disturbed conditions which at present prevail in the world.

We have also to provide the units necessary for maintaining adequate seagoing training for our personnel.

We have to station small Cruiser Squadrons on foreign stations, North and South Atlantic, Pacific, Indian, China and Australian waters to assist our trade and support the needs of the Empire.

Finally, we have to meet the requirements of Technical Training to ensure progress in modern devices and methods of warfare.

(b) *Strength of the Seagoing Fleet.*

6. We have based in Home Waters our Main Fleet, the Atlantic Fleet, consisting of 1 Fleet Flagship, 2 Battle Squadrons together comprising 9 ships, a Battle Cruiser Squadron of 4 ships, one of which is conveying His Royal Highness the Prince of Wales on his tour to the Dominions, 2 Light Cruiser Squadrons, 4 Destroyer Flotillas, 3 Submarine Flotillas and attendant vessels. This is the least number of units to ensure progressive tactical and sea training. A lesser number would destroy

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[1] This is not reproduced.

the possibility of exercises at sea under realistic conditions; the tactical units would be reduced to such an extent that the problems of gunnery concentration, fleet torpedo tactics, destroyer attacks, anti-submarine tactics could not be studied and practised; the sea training of officers and men would suffer, and progress would cease. To have one fleet in which the lessons of the war can continually be practised and new tactical methods devised has been one of our principal objects in maintaining that the Atlantic Fleet should be of the strength laid down.

7. In the Mediterranean we have stationed a Squadron of 6 Battleships, 1 Light Cruiser Squadron, 1 Destroyer Flotilla and attendant vessels. This moderately strong force is, in our opinion, necessary to meet political conditions in the near East. That this force is not excessive is shown by the fact that it has recently been necessary to detach a squadron from the Main, or Atlantic, Fleet to the Levant, the Mediterranean Fleet being fully employed on other important duties, and unable to meet all the demands made upon it.

8. As regards the squadrons on the China, African, North and South American and East Indies Stations, the need of them, which has always been recognised in the past, has never been more urgent than it is to-day, in view of the necessity for re-establishing the internal trade of the Empire, and promoting that with foreign countries. The Navy constitutes the police of the seas, and the experience teaches that an efficient Navy is the surest guarantee for peace.

(c) *Remarks on the Capital Ship.*

9. There has been some criticism of the maintenance in commission of the present types of vessels, especially in regard to the capital ship. A contrary policy has been openly advocated, this policy being based, it is presumed, on the idea that the battleship is dead and that submersible and air vessels are the types of the future. The Naval Staff has examined this question with extreme care, and as a result we profoundly dissent from these views.

10. In our opinion the capital ship remains the unit on which sea power is built up.

So far from the late war having shown that the capital ship is doomed, it has on the contrary proved the necessity for that type. On the German side the whole of the submarine campaign against merchant vessels was built up on the power of the High Sea Fleet.. On the British side the enemy submarines in no way interfered with the movements of capital ships in carrying out operations; destroyer screens, new methods of attack and altered tactical movements defeated the submarine.

11. Nor at present could the Board of Admiralty subscribe to the statement that Aircraft have doomed the capital ship. Aircraft are certainly of the highest importance in naval tactics, as regards reconnaissance, torpedo attacks and artillery observation, but their rôle in present circumstances is that of an auxiliary and not of a substitute for the capital ship. The past history of this question must be taken into account; many times has the doom of the battleship been pronounced. The introduction of torpedo craft was believed in certain quarters over 20 years ago to have settled its fate. The Board of Admiralty at the time refused to be carried away by the attractiveness of the idea of building small, cheap torpedo craft instead of battleships, and they proved to be right. History has shown that the introduction of a type to destroy the capital ship has been quickly followed by the evolution of counter-measures which sustain its power.

12. We therefore believe that the battleship must remain the principal unit, and that Fleet tactics and tactical training must be carried out with the battle squadron as the main unit. Nevertheless, it must be emphasised that although the battleship remains, its type may require to be altered. Advances in electricity, in the internal combustion engine and in science generally will inevitably necessitate an eventual change of type, and it is one of the principal functions of the Naval Staff to keep continuous watch on scientific development, with the object of ensuring that the type of capital ship designed meets the requirements of the future. It is even possible that the present battleship will change to one of a semi-submersible type, or even of a flying type, but such types are visions of the far future, not practical propositions of the moment. By gradual evolution and development the types forecasted may arrive, but the immediate abandonment of the capital ship in favour of a visionary scheme of aircraft and submarines, would leave the British nation destitute of sea power and without the means of progressive training.

(d) *Harbour Establishments.*

13. There remains to be considered that part of our Fleet organisation which deals with harbour establishments. The advance which was made in naval technical science during the war was very great.

Before the war we had no efficient mines, and instruction in mining was neglected; there was no system of minesweeping or of protection against mines as we now understand it; the various methods of submarine searching and attack had not been explored; the torpedo as a weapon was unreliable. The reason for this unsatisfactory state of affairs it is unnecessary to consider in this statement, but war experience has shown conclusively that if in times of peace we neglect development of these devices and instruction in their use, years of effort and vast expenditure are required to make good that neglect.

14. As a consequence, therefore, while it is desirable that we should keep down to bare minimum requirements the size of the seagoing fleets, it is essential that the Navy should possess all information concerning the latest scientific devices and their use; that in the event of war the seagoing fleet should be equipped with the best weapons modern science can provide; that there should be a personnel fully trained in technical science, and that the arrangements should be such that rapid expansion can take place both in equipping the reserve fleet and auxiliary units, and in training the reserve personnel for manning these units. For this purpose it is necessary to provide—

(*a*) Adequate experimental establishments for the development of the latest scientific devices in accordance with the requirements of the Staff.

(*b*) Training establishments where the personnel will be fully instructed in the same.

(*c*) Light Cruisers, Destroyers and other attendant craft for carrying out practical experiments with the devices developed by the scientific establishments and for practical instruction in their use to the personnel.

(e) *Scientific Research.*

15. The organisation of scientific research within the Navy which has been set up so as to ensure that the latest developments are understood by the Naval Service, and that developments both in types of vessels and in weapons will keep pace with scientific progress, is given in Appendix II. to this Memorandum. Under the Controller of the Navy there has been set up a Department of Scientific Research and Experiment. As the Scientific Adviser of the Controller, and in charge of this Department, there has been appointed a Director of Scientific Research who is responsible for the general direction and organisation of research work for naval purposes, keeping the Navy in touch with outside scientific establishments, and ensuring that the work at the various naval experimental establishments dealing with mining, sound signalling and navigational appliances proceeds with full cognisance of scientific progress and methods. He will arrange for additional scientific assistance being given to these establishments as requisite. Further, the Director of Scientific Research, by keeping in close association with the Naval Staff, will ensure that we are kept fully aware of the possible practical application of scientific progress in relation to naval needs, thus enabling us to formulate requirements as to types and weapons with a knowledge of the latest scientific possibilities, and to make ourselves better equipped for dealing with the vital problems of naval material development.

16. Consultations with outside institutions will be resorted to so as to gain the benefit of their research and experiments, but there are some problems which it will not be possible to deal with in this manner, owing to their secret or to their special naval aspect. Special Naval problems will be dealt with by the naval establishments—gunnery, torpedo, mining, signalling and anti-submarine; but for research work and secret development it is essential that the Naval Service should have a small central establishment of its own, independent of the special experimental establishments. Such an establishment was formed during the war at Shandon, and has performed, and is performing, good service. But Shandon is expensive to the country in its upkeep, and suffers from disadvantage in position both in regard to its distance from the naval ports and from the Admiralty, with the consequent liability that owing to insufficient co-operation and contact with naval thought, the research work may be conducted without the necessary consideration for practical requirements.

17. It has been decided, therefore, to close Shandon as soon as suitable accommodation can be provided elsewhere. Such work at Shandon as requires sea environment will be removed to existing Naval Establishments. All pure research work now being carried out at Shandon will eventually be transferred to a small Naval Institute adjoining the National Physical Laboratory at Teddington. This Institute, under the Director of Scientific Research, will be entirely controlled by the Admiralty, but its close association with the National Physical Laboratory will offer exceptional facilities for co-operation, and the Scientific Staff of the Institute will

have the advantage of personal acquaintance with the work being carried out in the Laboratory. It is hoped to have this establishment ready at the end of the present year; meanwhile Shandon, on a reduced scale, is being kept going until the establishment at Teddington is ready. To stop pure research work altogether at this moment would be a retrograde step, and might conceivably have a serious effect ultimately on development of types of ships and weapons, and on economy generally.

(f) *Technical Training.*

18. For the technical training of the personnel special schools are established at the naval ports of Portsmouth, Devonport and Chatham. The schools at Portsmouth are the largest, and attached to each of these schools is an experimental establishment dealing with the work of the school. This general system was in existence prior to the war, except that the experimental establishments were practically non-existent. As a result of the war, however, and of the progress in scientific and technical thought, large increases became necessary, especially in the establishments at Portsmouth.

19. As already stated, mining was considered in pre-war days to be a minor and unimportant branch of naval warfare; the staff dealing with this subject was small, and was attached to the Torpedo School.

The utility of mines was emphasised early in the operations of 1914, and the science of mining gradually assumed a position of extreme importance in naval strategy and tactics. On the tactical side as well as on the scientific and material side immense strides were made. This called for staff and technical knowledge of the highest order, and necessitated the setting up of a special Mining School at the Gunwharf, Portsmouth. This school, though it started late in the war, finally achieved great results, on both its experimental and its instructional side. It is essential to keep this school in being.

The Mining School at Portsmouth represents an additional establishment for which there was previously no provision. At this school the personnel will be instructed in the science of offensive and defensive mining, and also in devices for protection against mines, including the Paravane.

20. Apart from Mining, the Torpedo and Electrical, and Signal Schools have all had to be expanded to meet modern requirements. The war was responsible for tremendous developments, and all these developments have necessitated more advanced instruction for the personnel, and an increased staff to give this instruction. More highly organised scientific and experimental establishments have to be attached to the Schools.

21. Another technical branch of the Naval Service, which did not exist when the war commenced, is the Anti-Submarine School; the importance of this school in the future can hardly be over-estimated. We have seen the great effort which was made by means of the submarine to wrest from us our sea supremacy. Science alone can give us the antidote to the submarine, and we have taken steps, as will be seen in the detailed statement regarding the fleet, to ensure progress in experimental work and training. Development in this work will undoubtedly be required to meet the possibilities of the future, and proposals are under consideration for the establishment of a School of Anti-Submarine work in conjunction with an Anti-Submarine experimental station.

22. The submarine training establishments themselves have, as a result of the war, become more, rather than less, important. Future developments in the submarine may have a profound effect on Naval strategy and tactics. This subject is receiving continuous attention. Experimental work is being pressed forward, and in addition adequate steps are being taken to ensure that the high standard of the submarine personnel is maintained. The necessary staff and the attendant vessels have been allotted with this purpose in view.

23. It must be emphasised here that the policy with regard to instructional establishments generally has been to ensure the provision of an adequate experimental and instrumental staff, and of the appliances and seagoing tenders required for carrying out the experimental and instructional work with efficiency.

(g) *Personnel.*

24. It is upon the efficiency of the personnel that everything finally depends, and the Board of Admiralty are taking such steps as will ensure a Naval Service carrying on the traditions of the past, highly trained in staff and technical work, and will continue to do all in their power to secure conditions which will combine efficiency and contentment.

(h) *Entry and Training of Officers.*

25. First, as regards the officer personnel, it is proposed to adhere to the system known as the Common Entry System, by which is meant that the main body of Deck Officers and Engineering Officers will be trained in the same Cadet establishment. The Common Entry System was the system introduced by the Board of Admiralty in 1903, but since its inception it has undergone many modifications, and in explanation of the present policy it is desirable to give in brief outline the existing state of affairs.

26. Whereas in the past there have been two colleges for the training of Naval Cadets, it is now proposed that there be only one college at Dartmouth, and that the Osborne Establishment shall be closed.

One college is capable of dealing with the reduced number of Cadets required for the present fleet, and economy will result from the change.

27. The age of entry for Naval Cadets under the Common Entry System will be between 12½ and 14. Consideration has been given to the question of entering boys at a later age, but it has been decided to adhere to the present age as being that at which the majority of boys finish their private school education, before proceeding to Public Schools.

These boys will go to Dartmouth College, which will in effect be the Naval Public School where general education on naval lines will be continued under a system of education somewhat changed from that under which the Common Entry System has hitherto been conducted, in that more attention will be paid to general education, and the large amount of time which was previously devoted to Engineering will be reduced. The important factor at the Cadet College is to ensure that the boys have a thorough groundwork on which to build.

28. The Cadets will spend four years at Dartmouth and will then be sent for two terms (8 months) to a training battleship for their practical education and for gaining acquaintance with sea life, afterwards being drafted to sea as Midshipmen. As Midshipmen they will take their part as officers of the ship to which they are appointed, but their instruction will continue, the majority of their time being spent on their work as deck officers and one-eighth being devoted to Engineering.

After one year at sea, those Midshipmen who show a special aptitude and liking for Engineering will be permitted to volunteer for that branch of the Service; such Midshipmen will thereafter devote one-third of their time instead of one-eighth, as hitherto, to Engineering. The Midshipmen not volunteering for Engineering will continue to devote only one-eighth of their time to Engineering.

29. On reaching the rank of Sub-Lieutenant a further opportunity will be given to officers to volunteer for the Engineering branch of the service, and from these volunteers and from those who volunteered as Midshipmen selections will be made. It may be expected that the majority of officers selected will be from those who volunteer for Engineering after serving one year at sea as Midshipmen, and who since that time will have devoted a considerable portion of their time to Engineering studies.

Officers selected for the Engineering branch when Sub-Lieutenants will, after going through advanced courses of Engineering, be definitely placed on the Engineering side of the profession, and will not revert during the remainder of their career to deck duties. They will rise through the various ranks of the Engineering branch, with special rates of pay. Higher positions of administrative importance and responsibility at sea, at the Admiralty and in the Dockyards, will be open to them.

30. It requires to be emphasised that officers selected at this early age will devote the remainder of their career to Engineering. It is essential that the majority of officers forming the Engineering branch should be "whole time" officers. There is a definite distinction, both as regards knowledge and capabilities, between those who are to be trained in the science of naval war and strategical and tactical methods of fighting, and those who are to deal with the upkeep and maintenance of engineering and mechanical appliances which are necessitated by the complex machinery and weapons of modern war. Each side requires a special study, and for this reason final separation of the branches is essential.

31. At the same time, although there must be this definite division between the deck and the Engineer officers, each being charged with their own important sphere of responsibilty, nevertheless, each branch must understand and sympathise with the requirements of the other. In the exercise of strategy and tactics it is necessary that there should be full understanding of the engineering and mechanical possibilities and difficulties, and how such difficulties can be overcome. On the Engineering side it is equally necessary that there should be an understanding of the requirements of the strategist and tactician, in order that so far as practicable his requirements may be met and perhaps anticipated.

By means of the Common Entry System and training under a similar system until about the age of 20, when the rank of Commissioned Officer is reached, it is believed that this sympathy and understanding between Deck and Engineer Officers will be fully and completely obtained.

32. At present there is a further scheme whereby officers, after one year at sea as Lieutenant, are eligible to specialise in Engineering in the same way as officers specialise in Gunnery, Torpedo and Navigation.

After from 6½ to 8 years' service as specialists these officers may elect to revert to deck duties, and will be considered for promotion with other deck officers. The efficiency of this scheme, and the necessity for its continuance, is now under consideration, and will be decided without prejudice to officers already specialised under its provisions.

33. Briefly, therefore, the system of general training as an officer will be—

(*a*) Common Entry at about 13½ years of age.

(*b*) Three years eight months' (11 terms) training at Dartmouth.

(*c*) Eight months in a training battleship.

(*d*) About 2½ years at sea as Midshipman before becoming a Sub-Lieutenant.

(*e*) Midshipmen, after one year at sea, to be permitted to volunteer for Engineering and to be given special Engineering instruction.

(*f*) Sub-Lieutenants to be permitted to specialise in Engineering; Officers selected to be turned over to the Engineering branch, and to stay for the remainder of their career in that branch.

(*g*) Promotion to Lieutenant after serving about one year as Sub-Lieutenant, that is about the age of 22.

(*h*) Lieutenants after one year to be permitted to specialise in Engineering, such Lieutenants to remain from 6½ to 8 years in the Engineering branch, and then to be permitted to return to the deck branch or to remain in the Engineering branch. (Continuance now under consideration.)

(*i*) Promotion to Lieutenant-Commander after 8 years as Lieutenant, about the age of 30. Further promotion at approximately the ages and seniorities hitherto customary.

34. Although, as explained in the foregoing, it is the intention that the general age of entry shall be about 13½ years, and that boys so entered shall be sent to Dartmouth, it is highly desirable in the interests of the Naval Service that there shall be a special form of entry at a later age, so that boys who are not ready at the age of 13½ may still have an opportunity of entering the Naval Service, and also so as to allow of a certain number of Public School and other boys coming into the Service, and thus keeping the Navy in touch with the general educational system of the country. To permit of this, it has been decided to continue what is known as the Special Entry System, that is, a competitive examination between the ages of 17½ and 18½.

35. About 15 Special Entry Cadets will be taken under existing circumstances annually; these Cadets, who will already have received a general education, will be drafted to a cruiser training establishment, there to learn the special subjects required, and to gain an understanding of the sea. After one year in the training cruiser these Cadets will be sent to sea as Midshipmen, joining up with the Common Entry Midshipmen, and thereafter being trained on exactly similar lines. Their time of service as Midshipmen will be adjusted so that on reaching the rank of Lieutenant, Special Entry Cadets will as a whole be not more than one year older than those entered through Dartmouth College. This year's difference in age will make little or no difference to an officer showing zeal and ability; promotion to the rank of Commander and Captain being by selection, this year can be more than made good, and, in respect of a subsequent career, boys who enter under special entry conditions should understand that they suffer no disadvantage as compared with those entering through the main channel.

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(i) *Reduction of the Officer List.*

38. The present position with regard to the number of officers in the Naval Service is that, as a result of the expansion necessitated by the war, a surplus of officers exists.

Proposals for reducing the lists have been under consideration for some time, and provide for special rates of retired pay with a gratuity to Lieutenant-Commanders over the age of 36, and for a gratuity to Lieutenant-Commanders and Lieutenants under that age, and also Sub-Lieutenants and Midshipmen, who decide to take advantage of this offer and retire voluntarily within six months (or nine months in the case of officers serving abroad) of the promulgation of the order giving full details of the scheme.

39. Officers of Commander's rank and above are already eligible to retire with the half-pay of their rank. Owing to the considerable reduction in the number of vessels maintained in the Fleet, there will be fewer appointments open to officers of this rank, with a corresponding increase in the number unemployed. These will necessarily be placed on half-pay.

40. Reductions of the lists of the higher ranks of the Service are being effected automatically by retirements in accordance with the reputations.

The adverse effect of the reductions upon the prospects of younger officers is being mitigated by the generous action of distinguished Admirals in voluntarily seeking retirement.

41. As regards Naval Cadets now under training; again, as a result of the war, we have in the Osborne and Dartmouth Establishments a large surplus; so much so, in fact, that in every term passing out between July, 1920, and August, 1922, only about 60 per cent. of the boys at present forming these terms can actually go to sea.

It has been realised that for these boys we have a special responsibility, in that it is difficult for parents to withdraw them and send them to continue their education at a public school. The boys are in many cases too old to enter public schools, and the public schools themselves, even if the boys were fitted, could not take them owing to having no vacancies.

It has been decided, therefore, that, in regard to these terms, parents who wish to withdraw their boys, at or before the end of the coming summer term, and exercise this option before the 15th July next, will be granted the sum of £300 in order to continue the boy's education elsewhere; but if the parent prefers that his boy should finish his education—an education which fits him for all walks of life—he may leave the boy at the naval establishment. At each final examination, however, as the parent has been informed, 40 per cent. of the boys will not pass into the Naval Service; such boys will, however, have received a full education and should be ready to pass on to the University, or with special training to such professions as may be decided.

42. It must be understood in this connection that the normal regulations with regard to withdrawal of Cadets owing to failure to reach an adequate intellectual or physical standard, or through misconduct, will continue to operate, and that in regard to such Cadets no gratuity will be paid.

43. The special arrangements for reduction will not be put into effect with regard to the term passing out in April. To apply them to this particular term would be unfair to the parents owing to the shortness of time between this announcement and the final examination. Also, in the case of the term passing out in July next, the notice of these proposals is inadequate. In the particular case of this term, although only 60 per cent. of the boys will proceed to sea, it is proposed that as regards the 40 per cent. rejected, the parents of all these Cadets should be paid the sum of £300, unless such rejection comes under the normal regulations governing withdrawal referred to in the preceding paragraph.

44. So soon as the reduction of the lists and of the Cadets under training has been effected the following will be the general position: 40 cadets will be entered three times a year into Dartmouth College, and 15 Cadets annually by means of the Special Entry. As regards the future prospects of Cadets who stay in the Service and become Lieutenants, it may be expected that the pre-war percentage of promotions from Lieutenant-Commander and from Commander to Captain will be maintained.

(j) *Promotion from the Lower Deck.*

45. The foregoing gives the general system under which Deck and Engineer officers for His Majesty's Service will be entered and trained. There remains to be considered the system of promotion from the Lower Deck, which is being devised to ensure that men who display conspicuous character and ability shall have the opportunity of reaching the highest ranks of the Service.

46. At present, under the Regulations of the Special Entry Examination, a man from the lower deck between the ages of 17½ and 18½ can sit for this examination, and, if successful, he will become one of the Special Entry Cadets in the ordinary course of events. But owing to the lack of early educational facilities and also to the specialised training received since joining the Naval Service as boys, to the detriment of their education in such examination subjects as French and Latin, it is certain that only a small percentage of men could possibly take advantage of the Special Entry System. Some other system, therefore, than the Special Entry System must be looked to in order to give the lower deck of the Navy the opportunity of reaching higher rank, and to enable us to draw a proportion of officers from those who entered as boys on the lower deck.

47. The present "Mate system," whereby selected Petty Officers, provided they

have seven years' service, are promoted and receive commissions as Mates, and after a series of examinations and further service of two years become Lieutenants, was designed to form an avenue of promotion from the lower deck to the commissioned ranks. Many admirable officers have been produced in this manner. But the Mate System has suffered from the disadvantage that, owing to the operation of the seven years' service rule, the majority of men promoted to commissioned rank in this manner do not reach the rank of Lieutenant until 28-29 years of age or even later. When it is considered that an officer entering under normal conditions reaches the rank of Lieutenant at about 22 years of age, it will be seen that under this system there is little chance of a man promoted from Mate reaching a higher rank than Lieutenant-Commander.

48. To remedy this state of affairs, and to give a real opportunity to all men, a certain number of vacancies in each year will be available for men from the lower deck who may wish to become Officers.

A man on reaching the age of 21, provided he has satisfied the requirements of a Sea Selection Board and has passed the Seamanship Examination for Officer's rank, and has further taken a first-class certificate in the special educational test, embracing Mechanics, Geometry, History, Physics, and general subjects, will be eligible for selection before an Admiralty Selection Board. Those selected to fill the vacancies available will become Acting Mates, the earliest age being 21. Provided a man takes a first-class certificate in the further special courses he will undergo, he can become a Lieutenant at the age of 23. Candidates who take lower class certificates will be required to serve a longer period at sea before promotion to Lieutenant, the same procedure being followed in this respect as with Dartmouth College or Special Entry Officers passing for Lieutenant.

49. A man, therefore, who takes a first-class certificate, can be promoted to Lieutenant at about the same age as a Special Entry Cadet can reach that rank. He will then be on a precisely similar footing to other Lieutenants with regard to promotion, the highest ranks being within his reach.

50. In connection with this development of the Mate System, it is intended that those candidates who have been selected shall go through a special course designed to inculcate into them the essential requirements of an officer—knowledge of discipline, maintenance of morale and capacity for command of men; hitherto, men promoted from the lower deck have not had such a course. War experience has certainly shown the necessity for it, and in this respect the Navy cannot do better than adopt the methods so successfully practised by the sister Service, which, as explained by the Secretary of State for War, during the last months of the struggle produced 95 per cent. of the officers for the Army.

51. The above gives briefly in outline the proposals of the Board of Admiralty for ensuring that a proportion of the deck officers of the Navy shall be drawn from the boys' establishments and from those who have served on the Lower Deck. An analogous system is being applied to the Engineering branch as well; it will ensure to all the opportunity, which is their right, of reaching a high rank in His Majesty's Service.

52. It is not, however, the intention to rest here; it is hoped in the future to make further proposals with the object of broadening the field of entry and of removing the restrictions which financial contributions impose upon the promising lad who may display the qualities necessary in an efficient Naval Officer.

(k) *University Training of Naval Officers.*

53. There remains to be considered the higher education of the officers of H.M. Service. Before the war this education was almost entirely professional and technical. Officers in their Sub-Lieutenant's examination were required to pass examinations in various technical subjects. Later, they specialised in Gunnery, Torpedo, or Navigation, and went to special schools for this purpose, where their higher technical education was completed.

54. The whole of this question of higher education has been carefully reviewed in the light of war experience, and it appears that though the former system gave a type of officer of high professional attainments, yet, in many respects, it has left considerable room for improvement, the nature of the courses being rather too strictly professional and technical. Consequently, in certain respects, the Naval Officer was at a disadvantage as compared with his contemporaries in other walks of life, who had had the advantage of a more general education, and had come into contact with all shades of thought up to a comparatively late age.

55. The effect of the war was, in the case of the younger officers, seriously to interfere with their actual general education at the Osborne and Dartmouth Colleges prior to coming to sea, nor was it possible, in the case of a large number of officers,

to arrange for the special courses prior to their becoming Lieutenants. At the close of the war, therefore, these officers found themselves at a serious disadvantage; first, from the interruption of their general education, and secondly, from the fact that they had been unable as Sub-Lieutenants to pass through the courses at Greenwich College and the various Naval Schools.

56. To remedy this state of affairs, the authorities at Cambridge University were approached. The University authorities showed the greatest sympathy and gave us the most generous assistance, and as a result all those officers who had their studies interrupted by the war are being given a special course at Cambridge University. This course is designed to broaden the outlook on life and to bring officers into contact at an impressionable age with University thought and University ideas. It will not be until 1922 that all officers who had their studies interrupted will have been through Cambridge; meanwhile, we are convinced of the enormous benefit which has already resulted to those officers who have been through the course. We are grateful in the extreme for the help which has been given; it has shown the value to the Navy of this contact with the University, and it would be a profound mistake if this contact ceased so soon as the officers concerned have passed through their courses.

57. It is in contemplation to frame a scheme subject to the concurrence of the University authorities, under which in the future a University Course will be an integral part of training for about 25 per cent. of the Sub-Lieutenants in each year. It is considered that about this percentage will gain real and lasting benefit from the course.

58. The full details of this scheme of training will be worked out during the coming months. Broadly, the proposals are that all Sub-Lieutenants shall undergo, in addition to the technical courses of gunnery, torpedo, pilotage, and navigation, a special course of mathematics and physics, and an elementary war course at Greenwich. In this elementary war course, to which great importance is attached, Sub-Lieutenants will be given an introduction to strategy, tactics and the study of war. After Greenwich 25 per cent. will be selected for the Special University Course, the remainder passing to seagoing ships prior to promotion to Lieutenant.

(l) *Staff Training.*

59. In the interests of the future of the Service, great importance attaches to the selection and training of officers for the War Staff. A body of officers is required who have made special study of the lessons of history and of the war, and who are capable of sifting and applying the mass of evidence available.

60. Reduction of the Navy to the utmost limit in ships and material makes it the more important that the efficiency of the War Staff shall be of the highest order, and that during the forthcoming years there shall be passed through the Staff College a number of young officers whose training in staff work will ensure a common doctrine on strategical and tactical questions, the right application of the lessons of the past, and the ability to foresee the requirements of the future.

61. With this end in view a Naval Staff College has been set up at Greenwich. The first course commenced in June last and will be completed in June of the present year. In the next course commencing in September the number of officers will be increased and will, it is hoped, include representatives from the Dominions.

62. We must aim at training at least 40 Naval Officers a year, so that in 10 years 400 will have qualified for the Naval Staff and will be distributed through the various grades of the Naval Service. It is further highly desirable that the number of Army, Air Force, and Dominion representatives attending the Naval Staff College should be increased to ensure close co-operation between the Services, and to build up the naval thought of the Empire on the common doctrine on which the Navy must prepare itself. To carry this out it will be necessary to consider methods of increasing the Staff College accommodation; this matter is receiving serious attention, and it is hoped that a decision will be reached in time to enable the Staff Course in 1921 to be of the dimensions proposed; the matter will be referred to in the Naval Estimates of 1921-1922.

63. For the benefit of Senior Officers who are unable to take advantage of the Staff Course, a War College has been opened at Greenwich and a special staff appointed for instructional purposes. Strategy, tactics, and command are the principal subjects dealt with. The course at the War College will be preceded by technical courses at Portsmouth dealing with the use of weapons and progress in weapon technique. The War College at Greenwich opened on 1st March.

(m) *War Staff Organisation: Admiralty.*

64. As it exists to-day the War Staff at the Admiralty, it is correct to say, is largely a war product. Before the war the Staff consisted of the Intelligence Division, Operations Division, and Mobilisation Division. No "policy" or "planning" Division had then come into being, and no Division of the Staff dealt with the tactical side of naval war, types of ships, and use of weapons. The exigencies of war brought about an expansion of the Admiralty including the Divisions dealing with the operations and requirements of war, and emphasised the need for separating operational work on the one side from the work of administration and supply on the other. The reforms were carried out by the Admiralty under war conditions, and as a consequence certain logical divisions of duty in the Naval Staff organisation could not be effected.

65. The main consideration on which we have worked in improving the Admiralty Staff organisation has been to strengthen that side of the Staff which deals with the use and employment of weapons, the tactical questions consequent on change of weapons, types of vessels necessary to carry out naval policy, and staff questions dealing with scientific research and experiment. The staff view on these matters must be kept in the forefront, otherwise there is the danger that requirements of design and supply will dictate the principles relative to use and employment, resulting in the weapon becoming the master and not the servant of the tactician.

66. The war has enabled us to test the weapons forged during a century of peace, and has shown that some of them were unsuitable and inadequate. It is clear that the reason they were so was not so much the fault of the design or manufacture, as that the designers are now shown to have been incorrectly or incompletely advised as to the fighting requirements of the moment.

67. In order that progress in naval material may be steady, consistent, and well judged, and not impulsive and jerky, it must be based on continuous study and co-ordination of the lessons of war, and of experience and progress of our scattered fleets in their peace exercises and practices. The design of our ships must not and should not depend on the impulse of an individual nor merely on the mechanical possibilities of the moment, though the latter must necessarily limit the immediate accomplishment of our whole aim. Design must primarily depend on closely reasoned "requirements" based on evidence continuously and steadily accumulated from the lessons of our fleets, for whose use the ships and weapons are to be supplied. The aim must, and necessarily will, be always in advance of what can be provided by the science of the day.

68. The work thus indicated is the work of the Staff, and certain divisions of the Staff are therefore being grouped under the Assistant Chief of the Naval Staff to deal with questions relating to the use of weapons, types and designs to meet future developments, co-operation of aircraft and their employment in naval war, weapon technique and the introduction of new weapons. In fact the Assistant Chief of the Naval Staff will be responsible under the Chief of the Naval Staff to the First Lord for dealing with all staff questions affecting battle tactics and fighting efficiency.

69. The divisions of the Naval Staff dealing with Operations, Policy, Intelligence, and Training have been similarly placed under the Deputy Chief of the Naval Staff, the accepted principle of organisation that current work and future work shall not be dealt with by the same Division being closely adhered to. Under the Operations Division will come all those matters of current importance affecting the movements of ships and defence of ports, whilst the policy division will investigate future strategical questions, strengths of fleets, and development of dockyard and other facilities to meet future requirements, in accordance with the policy laid down by His Majesty's Government.

70. Briefly then the organisation of the Naval Staff to meet peace requirements is as follows:—At the head of the Naval Staff is the Chief of the Naval Staff, responsible to the First Lord for the fighting efficiency of the Fleet and the strategic and operational instructions to carry out policy. Under the Chief of the Naval Staff the Deputy Chief of the Naval Staff on the one side is responsible for Operations, Policy, Intelligence, and Training, and the Assistant Chief of the Naval Staff on the other side is responsible from the staff side for the development and use of material, including types of vessels, weapons, and tactics.

71. Under this organisation war experience will be fully laid to heart and the lessons applied to naval training and naval progress. Further, by these means the Staff is reduced to the minimum numbers compatible with efficiency, whilst at the same time rapid expansion on sound lines is allowed for in the event of emergency. From an organisation consisting of ten divisions with a personnel of 340 the new organisation will shortly consist of eight divisions with a personnel of about a quarter

of that number. They should supply a sufficient personnel to study and apply the results of our experience, and by neglect of that experience there would be a real danger of embarking on expenditure on wrong lines, the building of wrong types of vessels, incorrect tactics, and a faulty training of the personnel.

(n) *War Staff Organisation: Sea Commands.*

72. The War Staffs in all sea-going commands and at the harbour establishments have been organised on similar principles, with reduced staffs according to the size of the command. As with the Admiralty Staff, it is correct to say that before the war the Staffs at sea were only partially developed. There was a tendency for study of the technique of naval weapons to overshadow study of their employment.

73. War experience necessitated a change in these methods, and the division of staffs afloat into War Staff on the one side and a technical and administrative service on the other, is now an integral part of the organisation of the Navy. As trained War Staff Officers are produced they will be appointed in their various capacities to fill the positions in those commands. By interchange between officers on the Admiralty Staff and the commands afloat, and also by arranging that Staff Officers are appointed at intervals for general ship duties, leaving their staff work for the time being, it will be ensured that touch is kept between the Admiralty and sea thought and sea progress, and also that the Staff Officers themselves do not become divorced from the general sea service, with a consequent narrowness of outlook unable to appreciate through lack of sea experience the various problems in connection with sea training and the personnel afloat.

74. With the system of training and organisation of staffs on these lines, it is considered that the high efficiency of the officer personnel is ensured; that unity of thought and action will result from a common staff doctrine, and that the full requirements, present and future, will be met with the greatest efficiency and the greatest economy.

(o) *The Navy and the Air.*

75. We recognise fully that future naval policy is profoundly affected by possible developments in the air. All classes of aircraft employed as adjuncts to naval warfare have already shown the great effect they exercise in naval tactics and reconnaissance, and in combined operations. Looking ahead, it is possible to foresee tremendous developments in the air which may revolutionise eventually our present conception of sea warfare and sea strategy. But whilst giving the utmost consideration to the experience already gained, it is vital to this Empire that it should not be carried away by hasty proposals into the belief that air power is already a substitute for sea power. That day may come, but it is not at present in sight, and in the meantime to give way to these false ideas would be to throw themselves open to grave peril and to leave ourselves without the means of exercising that influence in world affairs which the Navy, as at present constituted, renders possible.

76. Nevertheless, our organisation must be such as to enable us to take full advantage of the progress in aerial matters and to appreciate fully the effect of this progress on the art of naval warfare, and to utilise to the utmost extent the combined effect of the air power and sea power for the defence of the Empire and the control of our sea communications.

77. The new organisation of the Admiralty Staff under the Assistant Chief of the Naval Staff is especially fitted for dealing with this vital matter. Arrangements have been made with the Air Ministry for close co-operation between the Admiralty Staff and the Air Staff, and for ensuring that the two Staffs are conversant with each other's problems and requirements.

78. To remove all misconception it should be stated with emphasis that we in no way contemplate a return to a separate Naval Air Service. It is recognised that the Air Ministry was created by Parliament as a result of war experience to further the development and maintenance of air power, and that to separate entirely from the Air Ministry that part dealing with the Navy would be to retard progress and result in a weakening both in development of material and the training of an air personnel.

79. At the same time it is an essential accompaniment of the establishment of a separate Air Ministry that the functions of the two Departments should be clearly defined, and more especially is this the case with regard to the responsibilities for the conduct of operations.

The Admiralty have represented to the Air Council that, in their opinion—

(*a*) the operations of all aircraft flown from H.M. ships and vessels with whatever object in view, that is to say, not only reconnaissance and artillery observation machines, but also machines which are carrying out operations in the air for offensive and defensive purposes; and

(b) all operations carried out by aircraft not flown from ships, but which are being carried out in connection with the command of the sea, that is to say, operations for oversea reconnaissance and for the attack of enemy ships and vessels—

should be under naval control. Dual control would be unworkable. In all matters relating to the command of the sea the Admiralty are and remain the responsible authority.

80. We are working out the scheme outlined in the memorandum by the Chief of the Air Staff issued as Cd. 467, and are in correspondence with the Air Ministry with a view to putting it into effect.

So far as can be foreseen, naval requirements will be met by the proposal ultimately to form a naval wing under the Air Ministry, with a personnel specially trained for naval work.

81. To assist in the development of this naval wing, it is proposed to second officers volunteering for air work to the Air Service for training and for subsequent service in the naval wing. Such officers as are specially fitted for work in the higher ranks of the Air Service will, by arrangement with the Air Ministry, be permitted to continue in the Air Force, but the majority of officers after their term of service in the Air Force will return to the Naval Service and continue their naval duties. Thus in the course of a few years there will be a body of Naval Officers who will have had experience in the Air Service, who will be equipped with knowledge regarding air matters, and who will be able to keep the Navy as a whole fully up to date in regard to air strategy and air tactics in relation to sea power.

82. Thus by seconding naval personnel to the Air Force, by an interchange of naval and Air Force officers between the Staff Colleges, and by the special organisation of the Naval Staff, the Naval Service will be prevented from falling behind in air matters through lack of foresight, through ignorance, or through a conservatism which refuses to understand the necessity of change consequent on development.

(p) *Dominion Naval Forces.*

83. Full and detailed reports have been rendered by Admiral of the Fleet Lord Jellicoe as the result of his recent tour, and are understood to be receiving the attention of the Governments of India and the Dominions. It is obvious that they must form a subject of consideration by the next Imperial Conference. Lord Jellicoe was everywhere received with the greatest warmth, and we believe that much benefit will result to the Empire from his tour, and that his work will be remembered with gratitude. The broad problems of Imperial Defence which are raised in his reports will meanwhile be studied by the Naval Staff, working in close touch with the Imperial General Staff and the Air Staff. Further, in order that the Admiralty may be prepared to deal with every aspect of the problems connected with the development of the Dominion Navies, the Dominions have been invited to appoint Officers to the Naval Staff of the Admiralty. These Officers will in time form an integral part of the Naval Staff when the measures outlined in regard to training at the Naval Staff College bear fruit.

(q) *Miscellaneous Personnel Questions.*

(i) *Officers of Accountant and Instructor Branches.*

84. The Committee which was appointed in July last, with wide powers of reference, to consider the position as regards the *Accountant* Branch is on the point of making its report. As soon as the report is received, the question of the future conditions of service and scope of employment of the Branch will be fully considered by the Board.

85. The *Instructor* Branch, which was being allowed to die out before the war, is being reconstituted on a wider basis. The Instructor Officer is being made responsible for the general education arrangements afloat, apart from work of a purely professional character, both as regards junior officers and ratings. It is anticipated that, apart from the advantages of having an officer of special University training on board, naval education generally will derive benefit from the change.

(ii) *Welfare Committee.*

86. A new experiment was made by the Admiralty last year in the shape of what is known as the Welfare Committee. Special facilities were given to enable full discussion to take place at the home Ports on matters affecting the different branches of the Service and the Lower Deck generally. Subsequently, representatives elected by the men themselves were attached in an advisory capacity to a Committee of officers, and a very large number of questions were brought forward and discussed at a series of meetings extending over several months. The Report of the Committee,

which is very voluminous, was made on the 3rd March. Any changes which are decided on after consideration of the Report will be promulgated to the Fleet in the usual manner. We attach great importance to the operations of this Committee, and we hope that, with sympathetic consideration, they may lead to many improvements in matters affecting the well-being of men.

The Board of Admiralty are much indebted to Admiral Sir Martyn Jerram for the care and sympathy with which he has presided over the deliberations of this Committee, in continuation of the work he had previously done in connection with the matters the Lower Deck.

(iii) *Sports and Recreations.*

87. A special section has been set up at the Admiralty to supervise Physical and Recreational Training in the Service. It is also part of its duty to promote the organisation of sports and games, and with this end in view a Sports' Control Board has been set up at the Admiralty, and various Sports Associations and local Sports Committees have been formed.

(iv) *Reserves.*

88. The question of the Naval Reserves has not yet been finally dealt with.

A Committee is considering alterations in the existing arrangements for enrolment, training and employment, and the organisation for rapid expansion on the outbreak of war.

It is therefore not possible to make any announcement at present, but the importance of early decision is recognised and the matter will be pressed.

For the moment it may be sufficient to say that the Reserves have fully proved their value during the war, and that it is intended to retain them as part of our peace organisation.

ABSTRACT OF NAVY ESTIMATES FOR 1920–1921.

Votes.		Gross estimate 1920–1921.	Net estimate 1920–1921.*	Net estimate 1919–1920.†
	I.—NUMBERS.		Total Numbers.	Total numbers.
A.	Total Number of Officers, Seamen, Boys, Coastguard, and Royal Marines .	136,000	136,000	280,000
	II.—EFFECTIVE SERVICES.	£	£	£
1	Wages, etc., of Officers, Seamen, and Boys, Coastguard, Royal Marines, *Women's Royal Naval Service*, and Mercantile Officers and Men	21,537,000	21,459,000	33,893,800
2	Victualling and Clothing for the Navy .	10,469,419	7,864,300	10,008,000
3	Medical Establishments and Services .	692,494	677,300	629,200
4	Civilians Employed on Fleet Services .	505,015	504,500	496,000
5	Educational Services	493,565	430,300	417,500
6	Scientific Services	396,767	302,000	463,000
7	Royal Naval Reserves	482,892	479,800	459,000
8	Shipbuilding, Repairs, Maintenance, etc.:			
	Section I.—*Personnel* . .	10,209,500	10,184,000	12,008,000
	Section II.—*Matériel* . .	17,535,000	8,499,000	10,685,700
	Section III.—Contract Work .	10,058,700	9,958,700	41,855,400
9	Naval Armaments *and Aviation* . .	6,327,934	6,260,000	15,790,100
10	Works, Buildings, and Repairs at Home and Abroad	5,245,000	5,209,000	5,667,700
11	Miscellaneous Effective Services . .	3,342,030	3,290,000	6,106,000
12	Admiralty Office	1,557,755	1,554,000	1,900,000
	Total Effective Services . £	88,853,071	76,671,900	140,379,400
	III.—NON-EFFECTIVE SERVICES.			
13	Half-Pay and Retired Pay . . .	2,472,384	2,452,000	1,296,600
14	Naval and Marine Pensions, Gratuities, and Compassionate Allowances .	4,402,775	4,386,900	15,134,000
15	Civil Superannuation, Compensation Allowances, and Gratuities . .	861,951	861,500	718,800
	Total Non-Effective Services . £	7,737,110	7,700,400	17,149,400
	GRAND TOTAL . . £	96,590,181	84,372,300	157,528,800

* After deducting appropriations in aid.

† Exclusive of Supplementary Estimate.

ADMIRALTY,
March 3rd, 1920.

WALTER H. LONG.
BEATTY.
M. E. BROWNING.
W. C. M. NICHOLSON.

A. E. M. CHATFIELD.
O. DE B. BROCK.
J. A. FERGUSSON.
LYTTON.

T. J. MACNAMARA,
Secretary.

STATEMENT SHOWING THE NUMBERS BORNE, THE EXPENDITURE ON NAVAL SERVICES FOR THE YEARS 1911–1912 TO 1919–1920 AND THE ESTIMATE FOR 1920–1921.

YEAR.	VOTE A. — Average numbers borne.	VOTE 1. — Wages, &c., of Officers, &c.	VOTE 2. — Victualling and Clothing.	VOTE 3. — Medical Establishments, &c.	VOTE 4. — Martial Law.	VOTE 5. — Educational Services.	VOTE 6. — Scientific Services.	VOTE 7. — Royal Naval Reserves.	VOTE 8. — Shipbuilding, Repairs, Maintenance, &c.			VOTE 9. — Naval Armaments.	VOTE 10. — Works.	VOTE 11. — Miscellaneous.	VOTE 12. — Admiralty Office.	VOTE 13. — Half Pay &c.	VOTE 14. — Naval, &c., Pensions.	VOTE 15. — Civil Superannuation, &c.	Balances Irrecoverable.	Total Expenditure.
									Section I. Personnel.	Section II. Matériel.	Section III. Contract Work.									
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
1911–12	132,792	7,486,817	2,723,606	259,022	3,770	147,904	73,105	387,359	3,522,581	5,105,368	11,969,102	3,800,266	3,167,529	558,361	405,943	937,300	1,457,515	406,649	2,060	42,414,257
1912–13	136,443	7,720,886	2,841,949	279,011	3,459	146,646	72,205	406,084	3,753,340	5,845,052	12,620,100	4,365,953	2,990,839	556,199	431,336	971,752	1,517,636	406,962	3,760	44,933,169
1913–14	142,960	8,262,203	3,034,246	281,382	3,640	156,468	53,375	440,028	4,128,108	6,746,714	13,217,129	4,747,829	3,520,026	734,491	460,221	990,233	1,562,093	392,223	2,212	48,732,621
					Civilians employed on Fleet Services. (*a*)															
1914–15	199,451	13,637,330	7,411,627	436,589	176,977	161,766	87,090	446,784	5,646,932	22,211,040	30,298,730	9,666,218	3,659,847	5,907,731	583,167	878,045	1,674,160	389,914	27,915	103,301,862
1915–16	297,008	24,321,519	10,796,024	578,703	444,907	171,610	108,535	755,201	7,868,812	44,778,970	64,513,255	25,639,203	5,710,782	16,321,128	851,066	717,519	1,730,117	409,161	17,085	205,733,597
1916–17	349,578	29,399,358	11,173,592	713,525	517,209	201,497	110,478	863,943	8,943,491	40,952,653	53,982,842	36,742,534	6,694,878	15,460,001	1,024,108	713,621	1,944,003	388,509	50,976	209,877,218
1917–18	406,977	37,559,536	13,481,159	792.569	561,308	210,243	152,160	874,930	12,660,160	36,494,694	70,609,055	34,177,359	6,556,769	9,193,802	1,454,835	709,227	1,446,247	413,746	41,092	227,388,891
1918–19	381,311	46,373,511	24.219,351	1,158,287	491,270	247,922	262,886	871,970	15,037,763	59,128,675	94,248,874	64,866,784	10,928,241	9,357,532	1,985,894	704,914	3,733,778	445,485	28,090	334,091,227
1919–20 (Estimated Actual)	275,000(*b*)	33,081,800	9,546,000	649,200	496,000	433,500	359,000	459,000	12,363,000	4,416,700	47,221.400	14,992,100	5,557,710	8,489,000	2,006,000	1,296,600	15,362,000	799,800	—	157,528,810
1920–21 (Estimate)	136,000(*c*)	21,459,000	7,864,300	677,300	504,500	430,300	302,000	479,800	10,184,000	8,499,000	9,958,700	6,260,000	5,209,000	3,290,000	1,554,000	2,452,000	4,386,900	861,500	—	84,372,300

Note.—The figures under Vote 9 include the cost of Naval Aviation Services from the year 1916–1917 to the year 1919–1920 inclusive.

(*a*) Replacing "Martial Law," transferred to Vote 11 in 1914–1915. **(*b*) Approximate number on 1st April, 1919.** **(*c*) Estimated number on 1st April, 1920.**

PAY, ALLOWANCES, AND PENSIONS.

In 1919 the Admiralty issued two White Papers [Cd. 270 and Cd. 149] dealing with pay, allowances, and pensions of officers and men of the Royal Navy and Royal Marines.

These two White Papers contained estimates of the financial cost of changes which have been made:—

(*a*) OFFICERS OF THE ROYAL NAVY AND ROYAL MARINES.

(1) The increases in full pay, based on the numbers of permanent officers in the Navy on 1st April, 1919, will cost annually £1,250,000.

(2) The increased cost in respect of the new regulations as to Half Pay is estimated at £56,000 for this year, but of this sum £31,000 is included in the estimate of Full Pay given above.

(3) The increases in allowances (lodging, provision, servants' allowances, and other allowances in the nature of pay), less certain allowances to be discontinued or merged in pay, will cost annually £140,000.

(4) The increase in the rates of Retired Pay will cost:—

	£
In the first instance	275,000
Eventually	750,000

(5) The additional *immediate* cost of the increases of pay for the demobilisable officers in the Navy on the 1st May, and for antedating the new scales for all concerned to the 1st February, is £698,000.

(6) The annual cost of the improvements made during the war, including the *ad interim* increase on the 1st February, 1919, based on the number of permanent officers in the Navy on the 1st April, is £1,263,000.

(7) The full charge, therefore, in respect of the present improvements for the financial year 1919–20 is £2,388,000, and this is exclusive of the charge for the year on account of the *ad interim* increase of 1st February, 1919, and the other improvements made during the war referred to in paragraph (6). It should be observed, however, that the charge in paragraph (5) is a non-recurring charge.

(*b*) OFFICERS AND MEN.

(1) The increases in pay herewith announced, based on the numbers of permanent men now in the Fleet, will cost annually £2,839,000.

(2) The increases in allowances (increased pay for good conduct badges; increased rate of good conduct gratuity; yearly allowance for good conduct gratuity; increase in "grog money"; increase in non-substantive pay; increase in Engine Room Artificers' special allowance; cost of National Health Insurance Contribution; conveyance of families and furniture on discharge to pension or on

TABLES OF FULL PAY.

1. Executive Branch.

Rank.	Pay prior to 1st February.			Total Pay plus Bonus 1st February.			Jerram-Halsey Committee Rates.			Approved Rates.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Midshipman	0	5	0	0	5	0	0	5	0	0	5	0
Acting Sub-Lieutenant	0	5	0	0	7	6	0	10	0	0	10	0
Sub-Lieutenant	0	7	6	0	10	0	0	10	0	0	10	0
Mate	0	11	0	0	15	0	0	16	0	0	16	0
Lieutenant on promotion	0	12	0	0	16	6	0	17	0	0	17	0
Lieutenant after 2 years	0	12	0	0	16	6	0	19	0		—	
Lieutenant after 4 years	0	13	6	0	18	0	1	1	0	1	0	0
Lieutenant after 6 years	0	13	6	0	18	0	1	4	0	1	4	0
Lieutenant after 7 years	0	13	6	0	18	0	1	7	0		—	
Lieutenant-Commander on promotion	0	16	0	1	1	0	1	10	0	1	10	0
Lieutenant-Commander after 2 years	0	16	0	1	1	0	1	12	0		—	
Lieutenant-Commander after 3 years	0	16	0	1	1	0		—		1	12	0
Lieutenant-Commander after 4 years	0	17	0	1	2	0	1	14	0		—	
Lieutenant-Commander after 6 years	0	18	0	1	3	0	1	16	0	1	14	0
Commander on promotion	1	3	0	1	8	6	2	0	0	2	0	0
Commander after 2 years	1	3	0	1	8	6	2	3	0		—	
Commander after 3 years	1	3	0	1	8	6		—		2	4	0
Commander after 4 years	1	3	0	1	8	6	2	6	0		—	
Commander after 6 years	1	3	0	1	8	6	2	9	0	2	8	0
Commander after 8 years	1	3	0	1	8	6	2	12	0		—	
Commander after 9 years	1	3	0	1	8	6		—		2	12	0
Commander after 10 years	1	3	0	1	8	6	2	15	0		—	
Captain on promotion	1	3	6	1	9	6	3	0	0	3	0	0
Captain after 2 years	1	3	6	1	9	6	3	3	0		—	
Captain after 3 years	1	3	6	1	9	6		—		3	5	0
Captain after 4 years	1	7	6	1	13	6	3	6	0		—	
Captain after 6 years	1	7	6	1	13	6	3	9	0	3	10	0
Captain after 8 years	1	13	0	1	19	0	3	12	0		—	
Captain after 9 years	1	13	0	1	19	0		—		3	15	0
Captain after 10 years	1	13	0	1	19	0	3	15	0		—	
Commodore 1st Class Rear Admiral	3	0	0	3	6	0	5	0	0	5	0	0
Vice-Admiral	4	0	0	4	6	0	6	0	0	6	0	0
Admiral	5	0	0	5	6	0	7	0	0	7	0	0
Admiral of Fleet	6	0	0	6	6	0	8	0	0	8	0	0

2. Engineer Branch.

	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Engineer Sub-Lieutenant	0	7	6	0	10	0	0	13	0	0	13	0
Mate (E)	0	11	0	0	15	0	0	19	0	0	19	0
Engineer-Lieutenant and Lieutenant (E) on promotion	0	12	0	0	16	6	1	0	0	1	0	0
Engineer-Lieutenant and Lieutenant (E) after 2 years	0	12	0	0	16	6	1	2	0		—	
Engineer-Lieutenant and Lieutenant (E) after 4 years	0	13	6	0	18	0	1	4	0	1	3	0
Engineer-Lieutenant and Lieutenant (E) after 6 years	0	13	6	0	18	0	1	7	0	1	7	0
Engineer-Lieutenant and Lieutenant (E) after 7 years	0	13	6	0	18	0	1	10	0		—	
Engineer-Lieutenant-Commander and Lieutenant-Commander (E) on promotion	0	16	0	1	1	0	1	14	0	1	14	0
Engineer-Lieutenant-Commander and Lieutenant-Commander (E) after 2 years	0	17	0	1	2	0	1	16	0		—	
Engineer-Lieutenant-Commander and Lieutenant-Commander (E) after 3 years	0	17	0	1	2	0		—		1	16	0
Engineer-Lieutenant-Commander and Lieutenant-Commander (E) after 4 years	1	0	0	1	5	0	1	18	0		—	

being invalided), less certain existing allowances to be merged (viz. re-engaged pay to seaman class; store allowance to victualling branch ratings; certain allowances to the Royal Marines now merged in higher pay), will cost annually £656,000.

(3) The increase in the basic rate for pension, including increase for medal, increase for badges, and the counting of all leading seaman time; together with the application of these improvements to pensioners on the roll who have served during the war, will cost:—

	£
In the first instance	873,000
Eventually	2,246,000

(4) The addition of 5*d.* a day age pension at 55 and 9*d.* a day at 65 to all life pensioners as from the 1st April will cost, over and above the amounts already dispensed by Greenwich Hospital on age and increased age pensions:—

	£
In the first instance	79,000
Eventually	407,000
Total annual *initial* cost.—Pay, pensions, and allowances of the present decisions	4,447,000
Total annual *eventual* cost.—Pay, pensions, and allowances of the present decisions	6,148,000

(5) The additional *immediate* cost of the increases of pay, etc., for the demobilisable men still in the Navy, and for antedating the new scales for all concerned to the 1st February, is £1,040,000.

The effect of the successive improvements in pay and allowances made will be seen from the following statement showing the Separation Allowances, etc., payable weekly in respect of a man with a wife and two children at the dates mentioned:—

Date.	Ratings below Petty Officer.	Petty Officer.	Chief Petty Officer.
	s. d.	*s. d.*	*s. d.*
1st Oct. 1914	10 0	11 0	12 0
1st Mar. 1915	13 0	14 0	15 0
18th Jan. 1917 (*see Note*)	16 6	16 6	16 6
3rd Oct. 1918 (*see Note*)	21 0	21 0	21 0
2nd Jan. 1919 (*see Note*)	23 0	23 0	23 0

Note.—From the 1st October, 1917, men have been relieved of a portion of the Allotment payable with separation allowance. This grant is known as the Allotment Concession, and is at the rate of 3*s.* 6*d.* a week. This sum must therefore be added to the rates given above so as to arrive at the weekly amount paid by the State from the 1st October, 1917.

Further, in order that the effect upon individuals of the new improvements now announced may be seen at a glance, the following table has been prepared giving the comparison between the weekly emoluments before the war and in future of men of the Seaman Branch:—

STATEMENT SHOWING THE WEEKLY EMOLUMENTS OF (I.) AN ABLE SEAMAN, (II.) A PETTY OFFICER, AND (III.) A CHIEF PETTY OFFICER UNDER PRE-WAR CONDITIONS AND ALSO UNDER THOSE NOW APPROVED.

RATING.	—	Sub-stantive Pay.	Non-substantive Pay.	Pay for Good Conduct Badges.	Food (value of Standard Ration and Messing Allowance).	Clothing (Kit Upkeep Allowance).	Separation Allowance and Allotment concession.†	Total.
		£ s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	£ s. d.
Able Seaman (single), with less than three years' man's service, holding the non-substantive rating of Seaman Gunner.	Pre-war rates	0 11 8	1 9	—	5 10	—	—	0 19 3
	New rates	1 8 0	1 9	—	13 1¼*	2 1	—	2 4 11¼
The same (married, with two children under 14 years).	New rates	1 8 0	1 9	—	13 1¼*	2 1	1 6 6†	3 11 5¼
Able Seaman (single), with over six years' man's service, holding the non-substantive rating of Gunlayer 2nd Class, or Seaman Gunner, also one Good Conduct Badge.	Pre-war rates	0 13 5	5 3	0 7	5 10	—	—	1 5 1
	New rates	1 11 6	5 3	1 9	13 1¼*	2 1	—	2 13 8¼
The same (married, with two children under 14 years).	New rates	1 11 6	5 3	1 9	13 1¼*	2 1	1 6 6†	4 0 2¼
Petty Officer (single), with less than three years' service in the rating, holding the non-substantive rating of Leading Torpedo Man, also two Good Conduct Badges.	Pre-war rates	1 1 0	3 6	1 2	5 10	—	—	1 11 6
	New rates	2 9 0	3 6	3 6	13 1¼*	2 1	—	3 11 2¼
The same (married, with two children under 14 years).	New rates	2 9 0	3 6	3 6	13 1¼*	2 1	1 6 6†	4 17 8¼
Petty Officer (single), with over six years' service in the rating, and re-engaged to complete time for pension, holding the non-substantive rating of Gunlayer 1st Class, also three Good Conduct Badges.	Pre-war rates	1 4 6	4 8	1 9	5 10	—	—	1 16 9
	New rates	2 13 8	7 0	5 3	13 1¼*	2 1	—	4 1 1¼
The same (married, with two children under 14 years).	New rates	2 13 8	7 0	5 3	13 1¼*	2 1	1 6 6†	5 7 7¼
Chief Petty Officer (single), with less than three years' service in the rating and re-engaged to complete time for pension, holding the non-substantive rating of Torpedo Gunner's Mate (higher scale), also three Good Conduct Badges.	Pre-war rates	1 6 10	9 4	1 9	5 10	—	—	2 3 9
	New rates	2 19 6	10 6	5 3	13 1½*	2 8	—	4 11 0¼
The same (married, with two children under 14 years).	New rates	2 19 6	10 6	5 3	13 1¼*	2 8	1 6 6†	5 17 6¼
Chief Petty Officer (single), with over six years' but less than nine years' service in the rating, and re-engaged to complete time for pension, holding the non-substantive rating of Gunner's Mate, or Gunlayer 1st Class, also three Good Conduct Badges.	Pre-war rates	1 11 6	9 4	1 9	5 10	—	—	2 8 5
	New rates	3 6 6	14 0	5 3	13 1¼*	2 8	—	5 1 6¼
The same (married, with two children under 14 years).	New rates	3 6 6	14 0	5 3	13 1¼*	2 8	1 6 6†	6 8 0¼

* Value on 1st April, 1919.

† Subject to revision at the end of 1919. (*Note.*—No change was made at this date, but from October, 1920, separation allowance was abolished, and a new "marriage allowance," at somewhat similar rates, was introduced.)

NOTE.—The above emoluments are in addition to free medical treatment, and service accommodation.

UNITED STATES NAVY.

Appropriation Bill, 1921 (*i.e.* 1920–21).

	Dollars.	Dollars.
Miscellaneous Pay, Naval Aviation, Marine Schools, etc., Bureau Charges (exclusive of Construction and Repair and Increase of the Navy)		266,516,316
Principal sums included in the above—		
Miscellaneous Pay	4,182,000	
Naval Aviation	25,403,000	
Bureau of Navigation—		
Transport and Recruiting	5,145,000	
Outfits on First Enlistment	6,081,000	
Instruments and Supplies	1,200,000	
Pay of Reservists, transferred	1,100,000	
Bureau of Ordnance—		
Ordnance and Ordnance Stores	17,500,000	
Bureau of Yards and Docks—		
Maintenance	9,000,000	
Philadelphia Dry Dock	1,000,000	
Plant at San Francisco	1,000.000	
Oil Storage, Puget Sound	1,050,000	
,, ,, Pearl Harbour	1,000,000	
Training Station, San Diego	1,000,000	
Repairs, etc., Navy Yards	4,000,000	
Bureau of Medicine and Surgery—		
Medical Department	2,500,000	
Bureau of Supplies and Accounts—		
Pay of the Navy	130,774,511	
Provisions	27,000,000	
Maintenance	14,934,065	
Freight, Fuel, Transportation, and Bureau of Construction and Repair		76,013,907
Principal sums included—		
Freight	2,000,000	
Fuel and Transportation	10,000,000	
Bureau of Construction and Repair—		
Construction and Repair of Vessels	31,000,000	
Bureau of Engineering—		
Engineering Repairs, etc.	30,000,000	
Naval Academy—		
Maintenance and Repairs	1,205,000	
Marine Corps Pay, etc.		28,876,046
Increase of the Navy—		
Construction and Machinery, etc.		52,000,000
Increase of the Navy—		
Torpedo Boats		12,000,000
Armour and Armament		49,000,000
		484,406.269

APPENDIX TO MERCHANT SHIPPING SECTION.

MERCHANT SHIPPING OF THE WORLD.

NUMBER AND TONNAGE OF MERCHANT VESSELS LAUNCHED.*

	1900.		1910.		1911.		1912.		1913.		1919.	
	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.
United Kingdom . . .	692	1,442,471	500	1,143,169	772	1,803,844	712	1,738,514	688	1,932,153	612	1,620,442
British Dominions . . .	40	9,563	60	26,343	62	19,662	84	34,790	91	48,339	263	358,728
United States	235	333,527	195	331,318	142	171,569	174	284,223	205	276,448	1051	4,075,385
Austria-Hungary . . .	12	14,889	8	14,304	16	37,836	12	38,821	17	61,757	—	—
Denmark	17	11,060	18	12,154	18	18,689	22	26,103	31	40,932	46	37,766
Holland	61	45,074	105	70,945	113	93,050	112	99,439	95	104,296	100	137,086
France	66	116,858	55	80,751	79	125,472	80	110,734	89	176,095	34	32.663
Germany	93	204,731	117	159,303	154	255,532	165	375,317	162	465,226	No returns.	
Italy	36	67,522	21	23,019	14	17,401	27	25,196	38	50,356	32	82,713
Japan	3	4,543	70	30,215	109	44,359	168	57,755	152	64,664	133	611,883
Norway	42	32,751	64	36,931	71	35,435	89	50,255	74	50,637	82	57,578
Russia	37	7,240	14	4,395	14	3,004	24	15,171	10	3,300	—	—
Spain	2	2,572	1	3,234	1	3,338	12	4,260	12	8,488	41	52,609
Sweden	19	5,735	17	8,904	11	9,427	22	13,968	25	18,524	53	50,971
Other Countries	9	5,627	32	12,868	23	11,022	16	27,223	61	31,667	36	26,725
World's Total . .	1864	2,304,163	1277	1,957,853	1599	2,650,140	1719	2,901,769	1750	3,332,882	2483	7,144,549

* Figures given include all steamers and sailing vessels of 100 gross tons and upwards.

MERCHANT VESSELS UNDER CONSTRUCTION.*

	1900.		1910.		1911.		1912.		1913.		1919.	
	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.	No.	Gross Tonnage.
United Kingdom	443	1,269,919	363	1,131,503	483	1,519,052	542	1,970,065	513	1,956,606	757	2,994,249
British Dominions . . .	—	—	16	12,231	6	4,060	21	14,194	38	38,785	113	251,480
United States	54	197,888	59	96,289	59	105,806	83	236,185	66	147,597	647	2,966,515
Austria-Hungary . . .	4	13,700	13	38,320	11	62,114	15	73,250	16	63,300	—	—
Denmark	8	10,703	8	9,625	12	19,272	13	20,897	12	25,362	56	100,335
Holland	24	32,447	24	47,620	45	79,713	61	114,811	41	126,867	126	328,338
France	41	121,158	24	109,106	26	123,080	32	175,588	39	229,020	65	216,775
Germany	70	203,984	63	160,932	89	350,365	92	542,519	102	544,682	—	—
Italy	30	87,720	6	15,505	18	19,160	21	52,370	23	53,809	125	314,547
Japan	7	18,034	28	33,058	35	21,993	36	45,703	14	47,797	64	309,474
Norway	22	19,680	27	20,920	43	21,738	43	27,851	49	42,614	61	92,719
Russia	—	—	—	—	—	—	12	13,978	1	5,620	—	—
Spain	2	2,500	1	3,838	3	4,900	4	6,909	3	6,855	28	107,463
Sweden	7	3,315	7	11,585	8	3,574	16	16,515	18	18,400	67	110,765
Other Countries	12	11,190	14	8,580	9	21,045	14	27,901	19	23,829	29	68,703
World's Total . .	724	1,992,238	653	1,699,112	847	2,355,872	1005	3,338,736	954	3,331,143	2138	7,861,363

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* The figures give the number and aggregate gross tonnage of steamers, motor ships, and sailing vessels under construction on December 31st of each year.

ANNUAL MERCHANT SHIPPING LOSSES OF THE WORLD.*

	1900.			1910.			1911.			1912.			1913.			1919.		
	No.	Tonnage.	% of Tonnage owned.	No.	Tonnage.	% of Tonnage owned.	No.	Tonnage.	% of Tonnage owned.	No.	Tonnage.	% of Tonnage owned.	No.	Tonnage.	% of Tonnage owned.	No.	Tonnage.	% of Tonnage owned.
United Kingdom .	213	245,645	1·86	129	222,069	1·27	138	210,440	1·18	137	262,156	1·44	113	199,453	1·07	99	151,653	·92
British Dominions	45	25,467	2·50	44	27,858	1·86	40	31,940	2·07	46	19,398	1·17	37	20,091	1·16	89	52,539	2·56
United States . .	99	56,154	2·76	75	50,996	1·82	84	57,103	2·03	64	39,796	1·40	91	71,469	2·38	115	150,272	1·15
Austria-Hungary .	5	2,146	·52	2	3,210	·41	3	1,369	·16	1	2,227	·25	3	5,536	·55	—	—	—
Denmark . . .	29	13,136	2·53	11	9,506	1·29	21	6,074	·81	14	7,503	·99	13	6,583	·86	15	5,295	·75
Holland . . .	8	5,026	·95	4	8,121	·80	5	9,952	·94	5	4,317	·38	4	1,340	·10	23	11,550	·73
France	49	51,525	3·82	31	20,789	1·10	40	19,560	·99	29	21,687	1·06	30	34,506	1·57	34	40,420	1·81
Germany . . .	58	50,578	1·91	39	44,233	1·02	29	36,148	·81	28	45,860	·99	31	56,379	1·11	50	24,167	—
Italy	47	36,577	3·72	17	18,534	1·40	24	27,695	2·07	25	27,877	1·99	26	26,881	1·77	8	3,096	·23
Japan	—	—	—	22	21,505	†	20	17,946	†	33	27,553	†	25	25,514	†	38	41,418	1·78
Norway . . .	152	98,367	6·0	73	67,971	3·37	75	65,196	3·02	63	59,939	2·61	61	60,648	2·47	41	44,132	2·37
Russia . . .	32	13,698	1·9	31	19,441	2·19	34	20,135	2·25	17	6,666	·71	29	23,894	2·45	4	4,771	·88
Spain	19	23,315	3·36	15	17,599	2·30	13	22,530	2·90	9	12,833	1·66	13	15,928	1·89	16	9,752	1·30
Sweden	40	14,651	2·3	31	15,260	1·66	49	21,874	2·35	30	12,700	1·31	30	17,327	1·65	38	29,021	2·92
Other Countries .	52	40,897	—	38	44,444	—	61	81,364	—	50	40,812	—	36	42,686	—	65	54,719	—
World's Total .	848	677,182	—	562	591,536	—	636	629,326	—	551	591,324	—	542	608,235	—	635	622,805	

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* Figures refer to steam and sailing vessels of 100 gross tons and over totally lost, condemned, etc. The tonnage given is gross for steamers and net for sailing ships.

† Japanese sailing vessels not included.

LARGEST STEAMERS OF THE WORLD.

Gross Tonnage.	Name.	Speed (knots).	Built.	Flag.	Owners.	Registered Dimensions.		
						Length.	Breadth.	Depth.
						ft.	ft.	ft.
56,000	Bismarck*	—	1914	†	†	912·0	100·0	57·1
54,282	Leviathan*	23	1914	United States	U.S. Shipping Board	907·6	100·3	58·2
52,022	Imperator*	23	1912	British	Shipping Controller	882·9	98·3	57·1
46,439	Olympic	23	1911	British	White Star	852·5	92·5	59·5
45,647	Aquitania	24	1914	British	Cunard	868·7	97·0	49·7
35,000	Columbus*	—	1913	†	†	750·0	83·0	48·9
32,000	Paris	—	1917	French	Cie. Gen. Transatlantique	734·9	85·2	59·1
30,704	Mauretania	25	1907	British	Cunard	762·2	88·0	57·1
25,570	George Washington*	19	1908	United States	U.S. Shipping Board	699·1	78·2	50·1
24,581	Kaiserin Auguste Victoria*	18	1905	British	Shipping Controller	677·5	77·3	50·2
24,547	Belgic	18½	1917	British	International Nav. Co., Ltd.	670·4	78·4	44·7
24,541	Adriatic	18½	1906	British	White Star	709·2	75·5	52·6
24,149	Rotterdam	17	1908	Dutch	Nederl. Amerik Stoomv. Maats	650·5	77·4	43·5
23,876	Baltic	17	1904	British	White Star	709·2	75·6	52·6
23,666	France	24	1912	French	Cie. Gen. Transatlantique	689·2	75·6	48·5
22,622	America	17½	1905	United States	U.S. Shipping Board	668·8	74·3	47·8
22,000	Empress of Canada	18	1920	British	Canadian Pacific Ocean Services	627·0	77·9	31·7
22,000	Duilio	—	1917	Italian	Nav. Gen. Italiana	601·4	75·9	50·1
21,500	Guilio Cesare	18½	1919	Italian	" " "	602·4	76·5	—
21,040	Cedric	17	1903	British	White Star	680·9	75·3	44·1
20,904	Celtic	17	1901	British	" "	680·9	75·3	44·1
20,602	Minnesota	13	1904	United States	Atlantic Transport Coy. of West Virginia	622·0	73·5	41·5
20,597	Cap Polonio	18	1914	British	Shipping Controller	637·7	72·3	39·5
20,000	William O'Swald	—	1914	†	†	587·8	72·0	39·5

* *Ex*-German ships.

† The flag and ownership of these *ex*-German vessels is not yet decided.

GENERAL PARTICULARS OF LARGE SHIPS OF VARIOUS NATIONALITIES.

Name of Ship	AQUITANIA.	MAURETANIA.	OLYMPIC.	LA FRANCE.	LEVIATHAN (formerly Vaterland).	IMPERATOR.
Name of Builders	John Brown & Co., Ltd., Clydebank	Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne	Harland & Wolff, Ltd., Belfast	Soc. des Chantiers et Ateliers de St. Nazaire	Blohm & Voss, Hamburg	Vulcan Co., Hamburg
Name of Owners or Managers	Cunard Co.	Cunard Co.	White Star Line	Cie. Générale Transatlantique	U.S. Shipping Board	British Shipping Controller
Year when built	1914	1907	1911	1910	1914	1912
Length over all	901 ft. 6 ins.	790 ft.	883 ft.	714 ft.	950 ft.	905 ft.
Length between perpendiculars (or moulded)	865 ft.	760 ft.	850 ft.	685 ft.	—	880 ft.
Breadth	96 ft. 6 ins.	88 ft.	92 ft.	75 ft. 9 ins.	100 ft.	98 ft.
Depth (moulded)	64 ft. 6 ins.	60 ft. 6 ins.	64 ft. 3 ins.	52 ft. 10 ins.	63 ft.	62 ft.
Gross Tonnage	45,647	32,000	46,439	24,448	54,190	52,117
Draught	35 ft. 3⅜ ins.	36 ft. 2½ ins.	34 ft. 7 ins.	30 ft.	38 ft. 6 ins.	35 ft. 6 ins.
Displacement (tons)	51,700	41,590	—	27,000	63,100	57,000
Number of Passengers—						
First Class	597	602	817	535	672 †	700
Second Class	614	430	510	442	535	600
Third Class	2000 (and 52 servants)	780	1216	908	2392 ‡	2690
Machinery Makers	John Brown & Co., Ltd.	Wallsend Slipway and Engineering Co., Ltd.	Harland & Wolff, Ltd., Belfast	Soc. des Chantiers et Ateliers de St. Nazaire.	Blohm & Voss, Hamburg	Vulcan Co., Hamburg
Type of Engines	Steam Turbines driving Four Screws	Steam Turbines driving Four Screws	Reciprocating with Turbine on Centre Shaft	Steam Turbines driving Four Screws	Turbines	Steam Turbines driving Four Screws
Number of Cranks	—	—	8	—	—	—
Diameters of Cylinders	—	—	Two 54 ins.; two 84 ins.; and four 97 ins.	—	—	—
Stroke of Pistons	—	—	75 ins.	—	—	—
Revolutions per Minute	180	200	Reciprocating engines, 77; Turbine, 165	241·5	180–190	185
Total Indicated or Shaft Horse-power	60,000	75,000	51,000	46,370	—	76,250
Number and Type of Boilers	21 Cylindrical double ended	25 Cylindrical (23 double-ended, 2 single-ended)	29 Cylindrical (24 double-ended, 5 single-ended)	19 Cylindrical (11 double-ended, 8 single-ended)	46 Water Tube	46 Water Tube
Number of Furnaces	168 (now fitted for oil burning).	192	159	120	138	46
Steam Pressure (lb. per sq. in.)	195	195	215	199	235	235
Total Heating Surface (sq. ft.)	138,595	159,000	142,454	99,303	210,440	203,009
Total Grate Area (sq. ft.)	3541	4060	3428	2555	3843	3763
System of Draught	Howden's	Howden's	Natural	Howden's	Howden's	Howden's
Speed on Service (knots)	23·5	25·5*	22·75	23·6	22·5	22·5

* NOTE.—This figure is the mean speed attained for 27 consecutive runs across the North Atlantic in one year covering a total distance of 77,500 nautical miles. The highest mean speed from Queenstown to New York was 26·06 knots.

† 80 Berths for Servants and 110 Pullman Berths in addition.

‡ Including 1542 Fourth Class Passengers.

FASTEST STEAMERS OF THE WORLD.

Speed (knots).	Name.	Gross Tonnage.	Date built.	Flag.	Owners.	L. (ft.).	B. (ft.).	D. (ft.).
25	Mauretania	30,704	1907	British	Cunard	762·2	88·0	57·1
24 and under 25.	Aquitania	45,647	1914	,,	,,	868·7	97·0	49·7
	Paris	1,774	1913	,,	L. B. & S. C. Rly.	734·9	85·2	59·1
	Jan Breydel	1,767	1909	Belgian	Belgian Government	348·0	40·0	23·2
	Pieter de Coninck	1,767	1910	,,	,,	348·0	40·0	23·2
	Princesse Elisabeth	1,747	1905	,,	,,	357·0	40·0	23·2
	Stad Antwerpen	1,384	1913	,,	,,	300·0	36·0	22·9
	Ville de Liege	1,366	1913	,,	,,	300·0	36·0	22·9
	France	23,666	1912	French	Cie. Gén. Trans-Atlantique	689·2	75·6	48·5
	Leviathan	54,282	1914	U.S.	U.S. Shipping Board	907·6	100·3	58·2
23 and under 24.	Imperator	52,022	1912	British	Shipping Controller	882·9	98·3	57·1
	Munster	2,646	1897	,,	City of Dublin Steam Packet Co.	360·0	41·5	27·3
	Olympic	46,359	1910	,,	White Star	852·5	92·5	59·5
	Princess Margaret	5,934	1914	,,	Canadian Pacific Rly.	395·0	54·0	20·0
	Ulster	2,641	1896	,,	City of Dublin Steam Packet Co.	360·0	41·5	27·3
	Newhaven	1,656	1911	French	Chemins de Fer de l'État Française and the L. B. & S. C. Rly.	292·0	34·6	22·1
	Rouen	1,656	1912	,,		292·0	34·6	22·1
	Agamemnon	19,361	1902	U.S.	U.S. Shipping Board	684·3	72·3	40·2
	Mount Vernon	18,372	1906	,,	,,	685·4	72·2	40·5
22 and under 23.	Biarritz	2,495	1915	British	S. E. & C. Rly.	341·2	42·1	24·0
	Brighton	1,129	1903	,,	L. B. & S. C. Rly.	273·6	34·2	14·1
	Dieppe	1,228	1905	,,	,,	273·5	34·8	13·8
	Maid of Orleans	2,384	1918	,,	S. E. & C. Rly.	341·1	42·1	16·0
	Manxman	2,048	1904	,,	Isle of Man St. Packet Co.	334·0	43·1	17·3
	Onward	1,671	1905	,,	,,	311·2	40·1	15·8
	St. Andrew	2,528	1908	,,	Fishguard and Rosslare Railways and Harbours Co.	351·1	41·1	16·5
	St. David	2,457	1906	,,	,,	350·8	41·1	16·5
	St. George	2,535	1906	,,	Gt. Eastern Rly.	352·0	41·1	16·2
	St. Patrick	2,456	1906	,,	Fishguard and Rosslare Railways and Harbours Co.	350·8	41·1	16·5
	Viper	1,713	1906	,,	Isle of Man St. Packet Co.	315·0	39·6	15·7
	Wahine	4,436	1913	,,	Union S.S. Co. of New Zealand, Ltd.	375·0	52·2	25·6
	Leopold II.	1,367	1892	Belgian	Belgian Government	340·0	38·0	15·0
	Princesse Clémentine	1,474	1896	,,	,,	341·3	37·8	14·2
	Oranje Nassau	2,885	1909	Dutch	Stoomv. Maats. "Zeeland"	350·0	42·7	16·4
21 and under 22.	Arundel	1,068	1900	British	L. B. & S. C. Rly.	269·1	34·1	14·1
	Arvonia	1,842	1897	,,	L. & N. W. Rly.	329·0	39·1	15·8
	Curraghmore	1,587	1919	,,	,,	307·1	40·1	14·5
	Empress	1,695	1907	,,	S. E. & C. Rly.	311·3	40·1	15·8
	Empress of Asia	16,909	1913	,,	Canadian Pacific Ocean Services, Ltd.	570·1	68·2	42·0
	Empress of Russia	16,810	1913	,,	,,	570·2	68·2	42·0
	Engadine	1,676	1911	,,	S. E. & C. Rly.	316·0	41·1	15·8
	Invicta	1,680	1905	,,	,,	311·2	40·1	15·8
	King Orry	1,877	1913	,,	Isle of Man St. Packet Co.	300·0	43·1	15·9
	Menevia	1,872	1902	,,	L. & N. W. Rly.	330·2	39·1	15·7
	Princess Patricia	1,158	1902	,,	Canadian Pacific Rly. Co.	270·0	32·1	11·6
	Riviera	1,675	1911	,,	S. E. & C. Rly.	316·0	41·1	15·8
	Victoria	1,689	1907	,,	,,	311·0	40·1	15·8
	Princesse Henriette	1,094	1888	Belgian	Belgian Government	300·0	38·0	13·6
	Rapide	1,195	1895	,,	,,	300·0	38·0	13·6
	La Lorraine	11,372	1900	French	Cie. Gén. Trans-Atlantique	563·1	60·0	35·9
	La Savoie	11,168	1900	,,	,,	563·1	60·0	35·9

FASTEST STEAMERS OF THE WORLD—*continued.*

Speed (knots).	Name.	Gross Tonnage.	Date built.	Flag.	Owners.	L. (ft.).	B. (ft.).	D. (ft.).
21 and under 22.	Ausonia	10,000	1915	Italian	Soc. Italiana di Servizi Marittimi	491·0	61·7	39·2
	Esperia	11,393	1918	,,	,,	492·1	61·7	34·1
	Venezia	979	1906	,,	D. Tripcovich	275·0	32·1	10·2
20 and under 21.	Antrim	1,954	1904	British	Midland Rly.	330·9	42·2	17·2
	Antwerp	2,400	Building	,,	Gt. Eastern Rly.	320·0	43·1	17·9
	Archangel	2,448	1910	,,	,,	330·8	43·2	17·8
	Bruges	2,400	Building	,,	,,	320·0	43·1	17 9
	Britannia	459	1896	,,	P. and A. Campbell, Ltd.	230·0	26·6	9·6
	Cambria	420	1895	,,	,,	225·0	26·1	9·4
	Devonia	520	1905	,,	,,	245·0	29·0	9·7
	Duchess of Argyll	593	1906	,,	Caledonian St. Packet Co.	250·0	30·1	10·1
	Duke of Argyll	2,036	1909	,,	L. & Y. and L. & N. W. Rlys.	330·9	41·1	17·1
	Duke of Cumberland	2,036	1909	,,	,,	330·7	41·1	17·1
	Empress of France	18,481	1913	,,	Allan Line	571·4	72·4	41·7
	Greenore	1,488	1912	,,	L. & N. W. Rly.	306·0	40·7	14·5
	Londonderry	1,968	1904	,,	Midland Rly.	330·6	42·1	17·1
	Loongana	2,448	1904	,,	Union S.S. Co. of New Zealand, Ltd.	300·3	43·1	23·3
	Maori	3,412	1907	,,	,,	350·5	47·2	24·7
	Queen Alexandra	785	1912	,,	J. Williamson & Co.	270·3	32·1	11·0
	Rathmore	1,569	1908	,,	L. & N. W. Rly.	299·5	40·2	14·8
	St. Denis	2,435	1908	,,	Gt. Eastern Rly.	331·0	43·2	17·8
	Westward Ho	438	1894	,,	P. and A. Campbell, Ltd.	225·0	26·1	9·5
	Charles Roux	4,104	1907	French	Cie. Gén. Trans-Atlantique	385·5	45·6	26·1
	Lutetia	14,654	1913	,,	Cie. de Nav. Sud Atlantique	579·0	64·1	36·7
	Massilia	15,000	1916	,,	,,	574·0	64·0	40·2
	Prins Hendrik	1,968	1895	Dutch	Stoomv. Maats. "Zeeland"	320·0	35·8	16·0
	Città di Catania	3,262	1910	Italian	Italian Government	363·5	42·1	18·8
	Città di Siracusa	3,497	1910	,,	,,	363·5	42·1	18·5
	City of Detroit III.	6,061	1912	U.S.	Detroit and Cleveland Navigation Co.	455·8	55·5	22·5
	Northland	2,055	1911	,,	Norfolk and Washington Steamboat Co.	291·2	51·0	18·0
	Southland	2,081	1908	,,	,,	291·2	51·0	16·1
	Tacoma	836	1913	,,	J. Green	209·4	30·0	17·6
	Kaiser	1,916	1905	Ex German	—	303·1	38·4	13·3

NUMBERS OF MERCHANT VESSELS OF VARIOUS SPEEDS.

Speed.	Number 1910.	Number 1920.	Speed.	Number 1910.	Number 1920.
25 knots and over	—	1	16½ knots	45	45
24 ,, and under 25	—	9	16 ,,	126	120
23 ,, ,, 24	—	10	15½ ,,	47	42
22 ,, ,, 23	—	15	15 ,,	215	178
21 ,, ,, 22	—	20	14½ ,,	85	70
20 ,, ,, 21	105*	30	14 ,,	276	281
19 ,, ,, 20	42	27	13½ ,,	138	156
18½ knots	24	18	13 ,,	462	403
18 ,,	60	56	12½ ,,	206	166
17½ ,,	48	42	12 ,,	732	698
17 ,,	83	76			

* This figure includes all merchant steamers of 20 knots and over in existence in 1910.

NUMBERS OF VESSELS CLASSED BY VARIOUS CLASSIFICATION SOCIETIES.*

Society.	1900.	1910.	1911.	1912.	1913.	1919.	1920.
Lloyds Register	9290	10,302	10,400	10,445	10,466	9175	9924
British Corporation	477	675	703	802	876	1002	1021
American Bureau of Shipping: Record of American and Foreign Shipping .	1284	1139	945	894	846	926	1581
American Bureau of Shipping: Gt. Lakes Register . .	—	609	651	537	572	442	393
Bureau Veritas	5122	4626	4936	5046	5165	5706	5666
Norske Veritas	2076	1560	1509	1505	1504	955	1034
Registro Navale Italiano	1116	1263	1263	1052	1442	699	975
Germanischer Lloyd	1761	2672	2698	2793	2848	—	—
Veritas Austro-Ungarico	1107	1041	1055	1111	1146	—	—
Adriatico Veritas	—	—	—	—	—	516	376
Nederlandsche Vereeniging van Assuradeuren	65	—	—	—	—	—	—

* Many vessels, of course, are not exclusively classed in one Register.

"EXPORTS" OF NEW SHIPS FROM THE UNITED KINGDOM.

SHIPS NOT REGISTERED AS BRITISH, WITH THEIR MACHINERY.

Year.	War Vessels.	Steam Ships (other than War Vessels).		Sailing Ships (other than War Vessels) including Boats.	Total of New Ships.
		Hulls and Fittings.	Machinery.		
	£	£	£	£	£
1903	74,480	2,798,737	1,222,108	188,504	4,283,829
1904	388,600	2,570,835	1,164,779	330,937	4,455,151
1905	50,000	3,693,422	1,516,183	171,693	5,431,298
1906	2,800,000	3,973,873	1,668,592	201,706	8,644,171
1907	554,700	6,586,449	2,550,702	326,262	10,018,113
1908	1,879,994	5,902,428	2,505,280	189,773	10,567,475
1909	247,000	3,698,556	1,819,618	161,940	5 927,114
1910	4,894,500	2,553,427	1,209,119	113,158	8,770,204
1911	25,000	3,745,349	1,632,402	259,564	5,663,115
1912	765,000	4,243,308	1,750,351	268,503	7,027,162
1913	2,617,100	5,867,179	2,336,509	205,742	11,026 530
1914	308,385	4,716,226	1,784,900	123,043	6,932,554
1915	—	1,170,606	472,597	49,548	1,692,661
1916	20,000	754 372	481,703	34,510	1,290,585
1917	—	706,084	347,354	33,869	1,087,307

FLUCTUATIONS IN THE PRICE OF A NEW, READY, 7,500-TON CARGO STEAMER.

Period.	£.
1898 (Sept.)	48,500
1905 (June)	36,500
1908 (June)	**36,000**
1910 (Jan.)	39,000
1912 (Dec.)	58,000
1914 (June)	42,500
1914 (Dec.)	55,000
1915 (Jan.)	60,000
1915 (June)	82,500
1915 (Sept.)	93,500
1916 (Jan.)	125,000
1916 (June	180,000
1917 (Jan.)	187,500
1918 (Jan.)	165,000
1918 (June)	180,500
1919 (Jan.)	169,000
1920 (Jan.)	**232,000**
1920 (June)	180,000

Compiled from "Fairplay," July 15, 1920.

NOTE.—The highest and lowest prices are given in heavy type.

IMPORTANT DATES IN THE DEVELOPMENT OF MARINE PROPELLING MACHINERY.

—	Approximate Date of Introduction in the United Kingdom.			
	Merchant.		Naval.	
Compound engines	—	1860	—	1865
Triple-expansion engines	—	1880	—	1885
Quadruple-expansion engines	—	1890	Not fitted	—
Cylindrical boilers	—	1862	—	1869
Water-tube boilers	Cross-channel	1911	Destroyers	1893
	Ocean liners	1914	Battleships	1897
Direct turbines	Cross-channel	1901	Destroyers	1898
	Ocean liners	1905	Light cruisers	1904
			Battleships	1906
Combination engines and and turbines	Intermediate liner	1908	(For cruising only)	1902
Geared turbines	Single-reduction	1911	Single-reduction	1913
	Double-reduction	1916	Not fitted	—
Electric propulsion	First attempts	1904	Not fitted	—
	Modern plant	1912	—	—
Oil fuel burning	First attempts	1870	Coal and oil—	
			Destroyers	1902
			Battleships	1904
	Modern plant	1892	Oil alone—	
			Destroyers	1910
			Battleships	1913
Heavy oil engines	First attempts	1904	Tender	1914
	Modern plant	1910	Submarines	1908

PROGRESS IN MARINE MACHINERY—ATLANTIC LINERS.

	1881.	1888	1893.	1899.	1903.	1907.	1914.
Ship Dimensions—							
Length	500′ 0″	528′ 0″	600′ 0″	685′ 0″	678′ 0″	760′ 0″	865′ 0″
Beam	50′ 0″	63′ 0″	65′ 0″	68′ 5″	72′ 0″	87′ 6″	96′ 6″
Performance—							
Speed in Knots	18·0	20·1	22·0	20·7	23·3	26·0	23·5
Horse Power	10,680	18,500	30,000	27,000	40,000	72,500	60,000
Engines—							
No. of Propellers . . .	One	Two	Two	Two	Two	Four	Four
Type of Machinery . . .	Vertical Compound	Vertical Triple Expansion	Vertical Triple Expansion	Vertical Triple Expansion	Vertical Quadruple Expansion	Steam Turbines	Steam Turbines
Cylinders on each shaft .	68″, 100″, 100″ by 72″ stroke	45″, 71″, 113″ by 60″ stroke	37″, 37″, 79″, 98″, 98″ by 69″ stroke	47½″, 79″, 93″, 93″ by 72″ stroke	37·4″, 37·4″, 49·2″, 49·2″, 74·8″, 74·8″, 112·2″, 112·2″ by 71″ stroke	— —	— —
Revolutions of Propeller .	64·2	86	81	78	80	180	180
Piston Speed (f.p.m.) . .	770	860	930	936	947	—	—
Referred M.P. (lb. per sq. in.)	29·1	35·3	35	35	35	—	—
Boilers—							
No. and type	— Cylindrical	9 double-ended Cylindrical	12 double-ended Cylindrical	15 double-ended Cylindrical	12 double-ended & 7 single-ended Cylindrical	23 double-ended & 2 single-ended Cylindrical	21 double-ended Cylindrical
Working-pressure (lb. per sq. in.)	100	150	165	192	225	195	195
System of Draught . .	Natural Draught	Closed Stokehold	Natural Draught	Assisted Draught	Natural Draught	Howden's	Howden's
Heating Surface per H.P. .	3·3 sq. ft.	2·75 sq. ft.	2·73 sq. ft.	2·77 sq. ft.	2·68 sq. ft.	2·19 sq. ft.	2·31 sq. ft.
H.P. per sq. ft. of grate .	8·57	14·3	11·4	13·75	12·8	17·9	16·9
Total Weight of Machinery "Steam up"	1860 tons	2516 tons	4935 tons	4414 tons	—	9936 tons	9302 tons
H.P. per ton of machinery	5·74	7·4	6·1	6·1	—	7·3	6·5
Coal Consumption per H.P. hour	—	1·7 lbs.	1·6 lbs.	—	—	1·4 lbs.	1·3 lbs.

PROGRESS IN MARINE MACHINERY—INTERMEDIATE OCEAN LINERS.*

Year	1880.	1892.	1911.	1914.	1920.
Ship dimensions—					
Length	400 ft.	470 ft.	520 ft.	550 ft.	550 ft.
Beam	45 ft.	53 ft.	64 ft.	66 ft. 6 in.	66 ft.
Performance—					
Speed in knots	12·5	12·5	14·5	16·5	17
Horse-power	3,000 I.H.P.	3,500 I.H.P.	7,500 I.H.P.	11,000 S.H.P.	11,000 S.H.P.
Engines—					
No. of propellers	One	Two	Two	Two	Two
Type of machinery . . .	Vertical compound	Vertical triple-expansion	Vertical quadruple expansion	Geared steam turbines	Geared steam turbines
Dimensions of cylinders . .	52-in., 96-in. by 66-in.	22½-in., 36½-in., 60-in. by 48-in.	26-in., 37-in., 53-in., 76-in. by 54-in.	Two H.P. and two L.P. turbines with single-reduction-gearing	Two H.P. and two L.P. turbines with double-reduction-gearing
Propeller (revs. per min.) .	61	80	82	133	85
Piston speed (feet per min.)	671	640	738	Turbine revs. 1,650	H.P. turbine, revs. 3,200; L.P. turbine, revs. 2,000
Referred mean pressure . .	20·5	32·0	37	—	—
Condenser surface per H.P. .	1·85	1·6	0·84	0·80	0·62
Boilers—					
No. and type	Two cylindrical	Two D.E. and one S.E. cylindrical	Five double-ended cylindrical	Five double-ended cylindrical	Five water-tube boilers, burning oil fuel (with superheaters)
Working pressure (lb. per sq. in.)	90	170	210	210	250
System of draught . . .	Natural	Natural	Natural	Howden's forced draught	Oil-burning with forced draught
Heating surface per H.P. .	3·1 sq. ft.	3·3 sq. ft.	3·25 sq. ft.	2·5 sq. ft.	2·25 sq. ft.
H.P. per sq. feet of grate .	7·6	10·0	11·75	17·5	—
Total weight of machinery "Steam up"	685 tons	795 tons	1,750 tons	1,800 tons	1,210 tons
H.P. per ton of machinery .	4·35	4·4	4·25	6·1	9·1
Coal consumption per H.P. hour	2·375 lb.	1·875 lb.	1·55 lb.	1·4 lb.	0·875 lb. (Oil).

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* This and the two succeeding tables are from "Two Centuries of Shipbuilding by the Scotts at Greenock" (1920).

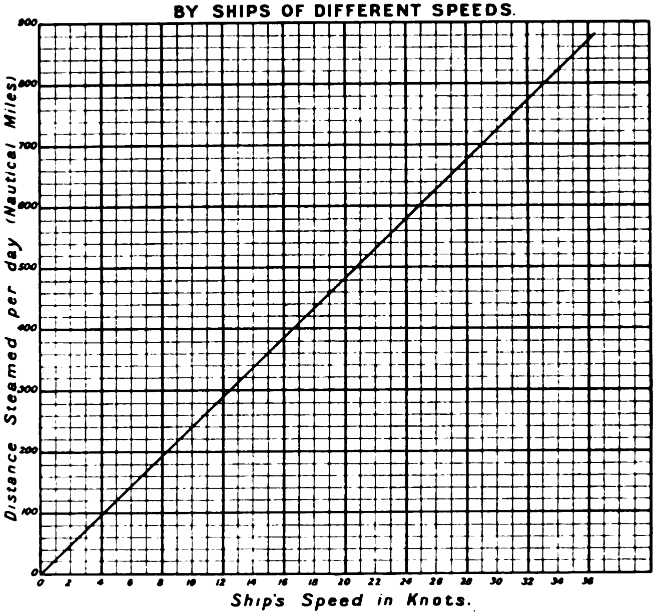
PROGRESS IN MARINE MACHINERY—CARGO STEAMERS.

Year	1877.	1885.	1911.	1914.	1920.
Ship dimensions—					
Length	314 ft.	320 ft.	440 ft.	450 ft.	503 ft.
Beam	35 ft.	38 ft.	52 ft. 6 in.	56 ft.	63 ft.
Performance—					
Speed in knots	11·25	12·25	13·25	14·25	14·25
Horse-power	775 I.H.P.	1,650 I.H.P.	4,200 I.H.P.	4,000–5,000 S.H.P.	7,000 S.H.P.
Engines—					
No. of propellers	One	One	One	One	Two
Type of machinery . . .	Tandem compound with flywheel	Triple-expansion	Triple-expansion	Steam turbines and single-reduction gearing; one H.P. and one L.P. turbine	Steam turbines and double-reduction gearing; two H.P. and two L.P. turbines
Propeller (revs. per min.) .	52	70	73	102	80
Piston speed (feet per min.) .	450	560	750	1,350 revs. of turbines	H.P. turbines, 3,500 revs.; L.P. turbines, 2,500 revs.
Referred mean pressure . .	23	31·5	35	—	—
Condenser surface per H.P. .	2·17	1·83	1·5	1·18	1·12
Boilers—					
No. and type	One-Oval ends and round middle portion	Two cylindrical	Two main cylindrical	Two cylindrical	Three cylindrical oil-fired boilers with superheaters
Working pressure (lb. per sq. in.)	70	150	190	195	200
System of draught . . .	Natural	Natural	Forced draught	Howden's forced draught	Oil burning with forced draught
Heating surface per H.P. (sq. ft.)	4·46	2·82	2·8	2·30	2·25
H.P. per sq. ft. of grate . .	7·6	10·4	16·25	20·0	—
Weights—					
Weight of machinery . . .	200	340	900	930	1,100
H.P. per ton of machinery .	3·87	4·85	4·67	6·45	6·35
Coal consumption per H.P. hour	About 2·5 lb.	1·95 lb.	1·65 lb.	1·45 lb.	0·85 lb. (Oil).

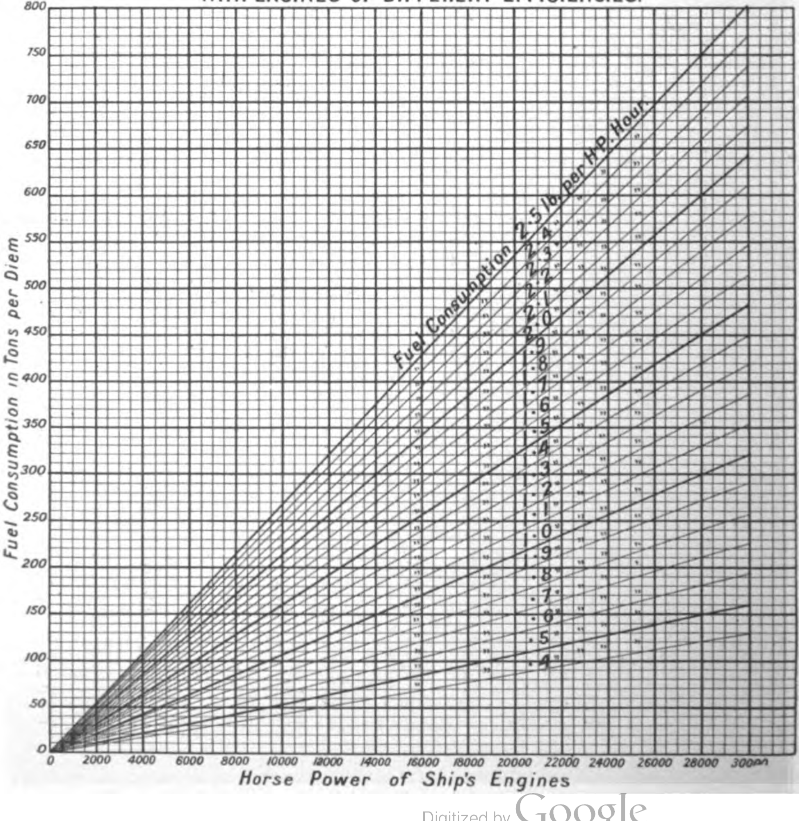
PROGRESS IN MARINE MACHINERY—CROSS-CHANNEL STEAMERS.

Year	1890.	1898.	1904.	1910.	1920.
Ship dimensions—					
Length	300 ft.	315 ft.	330 ft.	316 ft.	302 ft.
Beam	34 ft. 6 in.	37 ft.	42 ft.	41 ft.	35 ft. 6 in.
Performance—					
Speed in knots	18	19·75	19·5	21·5	23·5
Horse-power	4,400 I.H.P.	5,520 I.H.P.	5,500 S.H.P.	8,500 S.H.P.	12,300 S.H.P.
Engines—					
No. of propellers	Two	Two	Three	Three	Two
Type of machinery . . .	Three-cylinder triple-expansion	Four-cylinder triple-expansion	Direct steam turbines, one H.P. and two L.P.	Direct steam turbines, one H.P. and two L.P.	Geared steam turbines, two H.P. and two L.P. turbines
Propeller (revs. per min.). .	130	165	550	625	435
Piston speed (feet per min.) .	780	910	Turbines, 550 revs.	Turbines, 625 revs.	H.P. turbine, 2,600 revs.; L.P. turbine, 1,800 revs.
Referred mean pressure . .	30·75	43·0	—	—	—
Condenser surface per H.P. .	1·42	1·4	1·35	0·75	0·6
Boilers—					
No. and type	Five S.E. cylindrical	Four S.E. cylindrical	Two D.E. and one S.E. cylindrical	Seven water-tube	Eight water-tube
Working pressure (lb. per sq. in.)	160	180	150	190	195
System of draught . . .	Natural	Forced	Forced	Forced	Forced
Heating surface per H.P. (sq.ft.)	2·6	1·95	1·9	1·95	2
H.P. per sq. ft. of grate . .	12·25	17·5	16·5	15·0	22·0
Total weight of machinery—					
Steam up	590 tons	610 tons	590 tons	735 tons	1,055 tons
H.P. per ton of machinery .	7·45	9·62	9·3	11·6	11·65
Coal consumption per H.P. hour	2·25 lb.	2·1 lb.	1·8 lb.	1·7 lb.	1·50 lb.

DIAGRAM SHOWING DISTANCE STEAMED IN ONE DAY BY SHIPS OF DIFFERENT SPEEDS.



DAILY FUEL CONSUMPTION OF STEAMERS & MOTOR SHIPS WITH ENGINES OF DIFFERENT EFFICIENCIES.



PERSONS EMPLOYED IN VESSELS OF THE UNITED KINGDOM.*

Trades in which Employed.	Year.	Sailing Vessels. Persons Employed (including Foreigners).†	Steam Vessels. Persons Employed (including Foreigners).†	Total Persons Employed (including Foreigners).†
In the Home Trade. . .	1904	19,964	45,451	65,415
	1905	19,346	46,366	65,712
	1906	19,127	48,986	68,113
	1907	18,389	52,858	71,247
	1908	17,795	55,014	72,809
	1909	17,279	55,395	72,674
	1910	16,344	56,721	73,065
	1911 ‡	13,419	56,855	70,274
	1912	12,045	58,577	70,622
	1913	11,326	59,754	71,080
	1914	10,084	58,588	68,672
Partly in the Home and partly in the Foreign Trade	1904	441	5,585	6,026
	1905	739	7,701	8,440
	1906	439	8,586	9,025
	1907	320	5,362	5,682
	1908	332	6,022	6,354
	1909	283	8,957	9,240
	1910	282	11,250	11,532
	1911	282	11,487	11,769
	1912	233	9,991	10,224
	1913	222	13,081	13,303
	1914	224	12,298	12,522
In the Foreign Trade . .	1904	19,469	168,579	188,048
	1905	17,482	172,052	189,534
	1906	16,056	177,597	193,653
	1907	14,350	185,867	200,217
	1908	12,408	184,150	196,558
	1909	10,772	181,621	192,393
	1910	9,207	182,502	191,709
	1911	7,027	192,230	199,257
	1912	5,505	200,455	205,960
	1913	4,618	203,056	207,674
	1914	3,786	210,672	214,458
Total	1904	39,874	219,615	259,489
	1905	37,567	226,119	263,686
	1906	35,622	235,169	270,791
	1907	33,059	244,087	277,146
	1908	30,535	245,186	275,721
	1909	28,334	245,793	274,307
	1910	25,833	250,473	276,306
	1911	20,728	260,572	281,300
	1912	17,783	269,023	286,806
	1913	16,166	275,891	292,057
	1914	14,094	281,558	295,652

NOTES.—This return includes vessels belonging to the Isle of Man and the Channel Islands.

The number of persons employed in the year is the sum of the number of persons forming the first crew of each vessel employed during the year.

The Home Trade includes vessels trading or going within the following limits, viz. : the United Kingdom, the Isle of Man, the Channel Islands, and the Continent of Europe between the River Elbe and Brest.

The Foreign Trade includes vessels trading or going beyond the above limits.

Some vessels known to be trading abroad are omitted from the return owing to the fact that no late information of the numbers of their crews could be obtained.

* Statistics for the War-years 1915–1918 are not available.

† Including masters, pilots, and lascars.

‡ Vessels employed on rivers and going beyond smooth-water limits as defined in the regulations regarding passenger vessels, but not beyond *partially* smooth-water limits, have been excluded from the Employment Returns since the end of 1910. 781 sailing vessels of 34,976 tons, and 86 steam vessels of 3809 tons, which would have been included in the totals for 1911 had the basis remained unchanged, have thus been excluded.

BRITISH AND FOREIGN SAILORS AND LASCARS EMPLOYED IN VESSELS OF THE UNITED KINGDOM.*

	Sailing Vessels.			Steam Vessels.			Total.		
Years.	British.	Foreign.	Lascars.*	British.	Foreign.	Lascars.*	British.	Foreign.	Lascars.*
1903	33,067	9,141	30	143,453	31,255	40,991	176,520	40,396	41,021
1904	31,496	8,368	10	145,479	31,464	42,672	176,975	39,832	42,682
1905	30,213	7,323	31	150,279	32,388	43,452	180,492	39,711	43,483
1906	29,148	6,444	30	159,192	31,640	44,337	188,340	38,084	44,367
1907	27,382	5,669	8	167,466	32,025	44,596	194,848	37,694	44,604
1908	25,677	4,848	10	171,157	29,887	44,142	196,834	34,735	44,152
1909	24,407	3,927	—	174,067	27,946	43,960	198,474	31,873	43,960
1910	22,488	3,345	—	179,422	27,117	43,934	210,910	30,462	43,934
1911	18,346	2,382	—	186,719	28,401	45,452	205,065	30,783	45,452
1912	15,920	1,863	—	192,715	29,097	47,211	208,635	30,960	47,211
1913	14,329	1,837	—	198,241	30,802	46,848	212,570	32,639	46,848
1914	12,495	1,588	11	200,145	29,808	51,605	212,640	31,396	51,616

* Under the heading "Lascars" are included Asiatics and East Africans, whether British subjects or Foreigners, employed on vessels trading between India and this country, or entirely in Asiatic or American waters, and serving under Agreements which terminate in Asia.

Statistics for the War years, 1915–18, are not available.

PAY IN THE MERCHANT SERVICE.

MONTHLY RATES.

Officers.

Rating.	Cargo Steamers.	
	1914.	1919.
	£ s. £ s.	£ s. £ s.
First Mates	12 5 to 14 5	23 0 to 32 0
Second Mates	9 5 „ 12 15	21 10 „ 25 10
Third Mates	7 10 „ 10 10	19 0 „ 20 10
Boatswains	6 5 „ 6 10	16 0 „ 18 0
Carpenters	7 0 „ 7 10	17 0 „ 21 0
First Engineers	16 15 „ 24 0	27 0 „ 41 0
Second Engineers	12 5 „ 14 15	23 0 „ 32 0
Third Engineers	8 15 „ 11 15	21 10 „ 25 10

Rating.	Passenger Steamers.	
	1914.	1919.
	£ s. £ s.	£ s. £ s.
First Mates	17 0 to 19 15	28 0 to 35 0
Second Mates	11 0 „ 16 5	24 10 „ 28 0
Third Mates	9 0 „ 13 10	21 0 „ 24 10
Boatswains	6 0 „ 7 5	16 0 „ 18 0
Carpenters	7 0 „ 8 5	17 0 „ 21 0
First Engineers	22 5 „ 26 5	34 0 „ 40 0
Second Engineers	14 0 „ 17 0	28 0 „ 35 0
Third Engineers	12 0 „ 14 10	24 10 „ 28 0

Men.

Rating.	1914.	1919.
	£ s. £ s.	£ s.
British Seamen	5 0 to 5 10	14 10 (including £3 War bonus)
British Firemen	5 10 „ 6 0	15 0 (including £3 War bonus)

SEABORNE TRADE OF THE WORLD.

ATEMENT SHOWING THE IMPORTS (EXCLUDING BULLION AND SPECIE) INTO ALL THE COUNTRIES OF THE WORLD FOR THE YEAR 1912 FROM ALL OTHER COUNTRIES, WITH THE ESTIMATED PROPORTION CARRIED BY BRITISH VESSELS. (*See diagram, p.* 342.)

Countries into which Imported.	Estimated Total Imports by Sea.	Estimated Amount carried by British Vessels.	Estimated Proportion carried by British Vessels.
1. *Inter-Imperial Trade :—*	Million £.	Million £.	Per Cent.
Into United Kingdom from Empire . .	212	199	94
Into Empire from United Kingdom . .	206	144	
Into British Possessions outside the United Kingdom from British Possessions outside the United Kingdom . .	92	78	85
Total (1) . .	510	471	92
2. *Foreign Trade of the Empire :—*			
Into United Kingdom from Foreign Countries	533	346	65
Into Foreign Countries from United Kingdom	420	281	67
Into Empire from Foreign Countries .	143	79	55
Into Foreign Countries from Empire .	230	126	
Total (2) . .	1326	832	63
Total Trade of Empire (1 *and* 2) .	1836	1303	71
3. *Into Foreign Countries from Foreign Countries*	1550	465	30
Total Trade of the World . . .	3386	1768	52

STATEMENT SHOWING THE ENTRANCES WITH CARGOES AND IN BALLAST IN THE INTERNATIONAL OVERSEAS TRADE OF THE WORLD FOR THE YEAR 1911/1912 WITH THE PROPORTION OF ENTRANCES OF BRITISH VESSELS. (*See diagram, p.* 342.)

Vessels Entered.	With Cargoes and in Ballast.			British Proportion.
	British Vessels.	Foreign Vessels.	Total.	
1. *Inter-Imperial Trade :—*	Million tons net.	Million tons net.	Million tons net.	Per Cent.
At United Kingdom Ports from Empire	8·9	1·0	9·9	90
At Empire Ports from United Kingdom	10·0	1·0	11·0	91
At Empire Ports outside United Kingdom from other Empire Ports outside United Kingdom	21·8	5·4	27·2	80
Total (1) . .	40·7	7·4	48·1	85
2. *Foreign Trade of the Empire :—*				
At United Kingdom Ports from Foreign Countries	35·4	30·9	66·3	53
At Foreign Ports from United Kingdom	34·3	31·0	65·3	53
At Empire Ports from Foreign Countries	25·2	26·3	51·5	49
At Foreign Ports from Empire Ports .	28·4	26·6	55·0	51
Total (2) . .	123·3	114·8	238·1	52
Total Trade of Empire (1 *and* 2) .	164·0	122·2	286·2	57
3. *Trade between Foreign Countries* . .	67·0	214·0	281·0	24
Total Trade of the World	231·0	336·2	567·2	41

DIAGRAM SHOWING THE EMPLOYMENT OF SHIPPING OF ALL NATIONS IN 1911 IN THE INTERNATIONAL TRADE OF THE WORLD. TONNAGE ENTRANCES AND CLEARANCES WITH CARGOES AND IN BALLAST IN THE FOREIGN TRADE ARE PLOTTED FOR ALL COUNTRIES IN WHICH THE AMOUNT EXCEEDED 10,000,000 TONS.

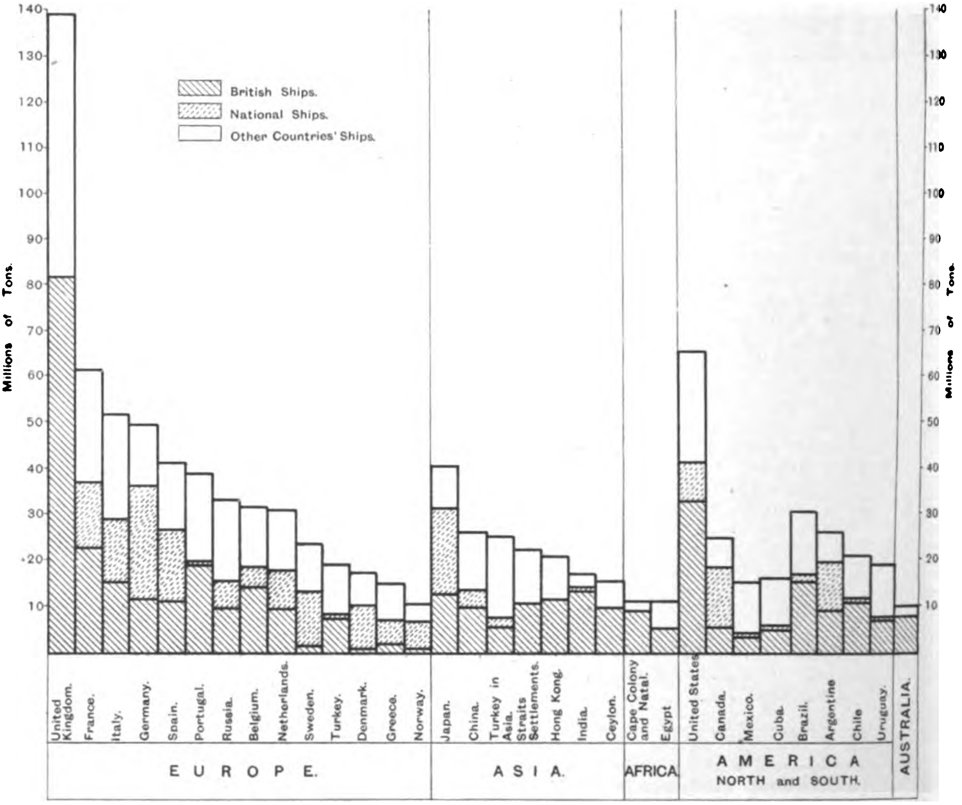
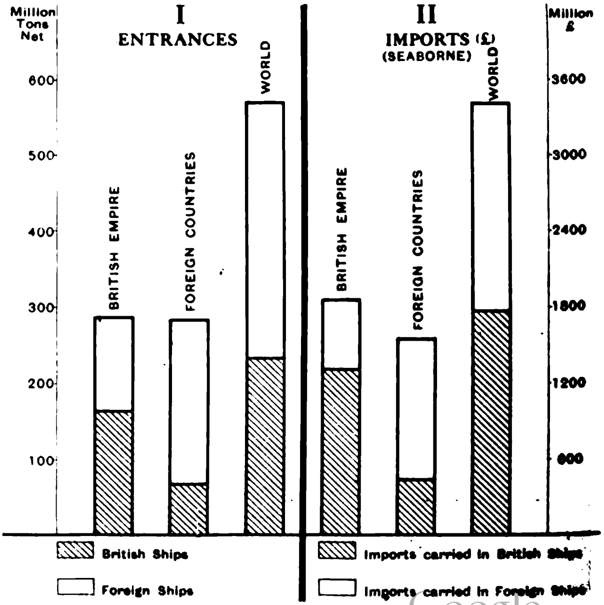


DIAGRAM SHOWING (I) THE PROPORTION OF THE TOTAL ENTRANCES WITH CARGOES AND IN BALLAST OF BRITISH VESSELS IN THE INTERNATIONAL OVERSEAS TRADE OF THE WORLD; AND (II) THE ESTIMATED PROPORTION OF THE IMPORTS INTO ALL COUNTRIES OF THE WORLD CARRIED IN BRITISH VESSELS.

(1911–12.) (1912.)



STATEMENT SHOWING IN VALUE (£) THE TOTAL IMPORTS AND EXPORTS OF THE BRITISH EMPIRE AND OF THE PRINCIPAL FOREIGN COUNTRIES FOR THE YEAR 1912, WITH AN ESTIMATE OF THE PROPORTION OF IMPORTS AND EXPORTS SEABORNE.

	Imports.	Exports.	Total Imports and Exports.	Overland.	Seaborne.	Proportion Seaborne.
	Million £.	Million £.	Million £.	Million £.	Million £.	Per Cent.
United Kingdom . . .	745	599	1344	—	1344	100
British Dominions and Possessions	553	523	1076	100	976	91
British Empire . . .	1298	1122	2420	100	2320	96
Foreign Countries :—						
Germany	526	440	966			
United States . . .	342	452	794			
France	329	269	598			
Netherlands	297	258	555			
Belgium	198	158	356			
Russia, including Finland	142	174	316			
Austria-Hungary . .	148	114	262			
Italy	148	96	244			
Argentine	77	96	173			
Greece	63	75	138			
Switzerland	81	56	137			
China	72	57	129			
Japan	65	55	120			
All other Countries .	604	628	1232			
Total Foreign Countries	3092	2928	6020	1700	4320	72
Grand total	4390	4050	8440	1800	6640	79

STATEMENT SHOWING THE NUMBER AND NET TONNAGE OF VESSELS THAT PASSED THROUGH THE SUEZ CANAL IN THE YEARS 1913 AND 1919, DISTINGUISHING THE PRINCIPAL NATIONALITIES. (*See diagram* C, *page* 346.)

Nationality of Vessels.	Number of Passages.		Net Tonnage of Vessels.		Numbers as Percentages of Total.		Tonnages as Percentages of Total.	
	1913.	1919.	1913.	1919.	1913.	1919.	1913.	1919.
British	2951	2679	12,052,484	11,355,067	58·0	67·2	60·2	70·9
Japanese . . .	68	438	343,732	1,449,839	1·3	11·0	1·7	9·1
Dutch	342	181	1,287,354	754,517	6·7	4·5	6·4	4·7
French	256	112	927,787	475,424	5·0	2·8	4·6	3·0
Inter-Allied . .	—	88	—	431,385	—	2·2	—	2·7
Italian	110	117	290,576	317,295	2·2	2·9	1·5	2·0
Danish . . .	56	75	171,848	314,708	1·1	1·9	0·9	2·0
Norwegian . . .	44	73	93,313	256,520	0·9	1·8	0·5	1·6
American (U.S.A.)	8	54	7,476	168,278	0·2	1·4	—	1·0
Swedish . .	33	43	122,957	155,902	0·7	1·1	0·6	1·0
Greek	17	39	54,560	102,601	0·3	1·0	0·3	0·6
Spanish . . .	26	36	75,643	97,822	0·5	0·9	0·4	0·6
German . . .	778	—	3,352,287	—	15·3	—	16·7	—
Austria-Hungarian	246	—	845,830	—	4·8	—	4·2	—
Russian . . .	110	23	340,595	55,322	2·2	0·6	1·7	0·3
All others . . .	40	28	67,442	79,122	0·8	0·7	0·3	0·5
Total . .	5085	3986	20,033,884	16,013,802	100·0	100·0	100·0	100·0

NOTE.—The above figures include not only Merchant Vessels and Mail Steamers, but also Warships and Transports as well as Government Chartered Vessels.

STATEMENT SHOWING THE NATIONALITY AND NET TONNAGE OF VESSELS WHICH ENTERED AND CLEARED WITH CARGOES IN THE FOREIGN TRADE OF THE UNITED KINGDOM FOR THE YEARS 1913 AND 1919. (*See diagram* A, *page* 346.)

Nationality.	Entrances.		Clearances.		Percentages.			
					Entrances.		Clearances.	
	1913.	1919.	1913.	1919.	1913.	1919.	1913.	1919.
	Tons.*	Tons.*	Tons.*	Tons.*				
British	32,291	22,065	40,102	21,958	65·8	74·7	59·1	63·6
Foreign:—								
Norwegian	3,285	1,436	4,683	3,052	6·7	4·9	6·9	8·8
United States of America	724	1,625	370	609	1·5	5·4	0·5	1·8
Swedish	1,891	1,018	3,016	1,582	3·9	3·5	4·5	4·6
Dutch	1,702	951	2,536	1,522	3·5	3·2	3·7	4·4
Danish	1,161	479	2,613	1,458	2·4	1·6	3·9	4·2
French	999	412	1,975	2,099	2·0	1·4	2·9	6·1
Belgian	1,369	389	957	612	2·8	1·3	1·4	1·8
Japanese	140	340	282	240	0·3	1·2	0·4	0·7
Spanish	1,060	322	1,694	438	2·2	1·1	2·5	1·3
Italian	122	91	955	287	0·2	0·3	1·4	0·8
Russian	678	90	937	114	1·4	0·3	1·4	0·3
Greek	221	86	1,072	260	0·4	0·3	1·6	0·7
German	3,166	8	5,730	3	6·4	—	8·5	—
Austria-Hungarian	128	—	715	—	0·3	—	1·0	—
Other Nationalities	125	242	185	318	0·2	0·8	0·3	0·9
Total Foreign	16,772	7,491	27,719	12,595	34·2	25·3	40·9	36·4
Total British and Foreign	49,063	29,556	67,821	34,553	100·0	100·0	100·0	100·0

	Entrances and Clearances.		Percentage.	
	1913.	1919.	1913.	1919.
	Tons.*	Tons.*		
British	72,393	44,023	62	69
Foreign	44,490	20,085	38	31
Total	116,883	64,108	100	100

* *Figures in thousands,* i.e. *hundreds omitted.*

STATEMENT SHOWING THE NUMBER OF VESSELS THAT PASSED THROUGH THE PANAMA CANAL IN THE YEARS ENDED 30TH JUNE, 1915, 1916, 1917, 1918, AND 1919, DISTINGUISHING THE PRINCIPAL NATIONALITIES. (*See diagram* D, *page* 346.)

	Eleven months ended 30th June, 1915.	Year ended 30th June, 1916.	Year ended 30th June, 1917.	Year ended 30th June, 1918.	Year ended 30th June, 1919.	Percentages.				
						1915.	1916.	1917.	1918.	1919.
British	465	358	780	699	623	42·7	45·5	41·6	32·8	30·7
American	470	238	464	625	839	43·2	30·2	24·7	29·3	41·4
Norwegian	42	45	150	296	124	3·9	5·7	8·0	13·9	6·1
French	3	1	9	52	96	0·3	0·1	0·5	2·5	4·7
Chilean	35	33	99	96	78	3·2	4·2	5·3	4·5	3·9
Japanese	6	24	72	53	75	0·6	3·1	3·8	2·5	3·7
Danish	23	18	43	100	74	2·1	2·3	2·3	4·7	3·6
Peruvian	4	30	86	83	61	0·4	3·8	4·6	3·9	3·0
Dutch	7	15	74	49	16	0·6	1·9	3·9	2·3	0·8
Other Nationalities	33	25	99	77	43	3·0	3·2	5·3	3·6	2·1
Total	1088	787	1876	2130	2029	100·0	100·0	100·0	100·0	100·0

TRADE OF PRINCIPAL COAL-SHIPPING CENTRES, 1913.

	Coal Exports. Tons.	Other Exports. Tons.
Barry Docks and Penarth	20,095,051	121,370
Newcastle, North Shields, and South Shields	13,619,502	318,445
Blyth	4,475,827	10,323
Newport (Mon.)	4,841,786	234,200
Port Talbot, Briton Ferry, Neath Abbey, and Porthcawl	2,318,699	5,374
Sunderland	4,027,806	3,592
Swansea	4,451,597	471,968
Burntisland	1,952,030	465
Methil	2,594,157	1,223
Total Nine Centres	58,376,455	1,166,960

STATEMENT SHOWING (IN RESPECT OF THE NINE PRINCIPAL COAL-SHIPPING CENTRES OF THE UNITED KINGDOM) IN COLUMN 1 THE NUMBER AND NET TONNAGE OF VESSELS WHICH CLEARED WITH CARGOES TO BRITISH POSSESSIONS AND TO EACH OF THE PRINCIPAL FOREIGN COUNTRIES, AND IN COLUMN 2 THE TOTAL NUMBER AND TONNAGE OF EACH FOREIGN COUNTRY'S SHIPS WHICH CLEARED FROM THOSE CENTRES TO FOREIGN PORTS. (*See diagram* B, *page* 346.)

Countries.	Column 1. Countries to which Vessels departed.		Column 2. Total Clearances of National Ships from the 9 Centres.	
	No. of Vessels.	Net tonnage.	No. of Vessels.	Net tonnage.
Russia	1,405	1,421,049	422	427,832
Sweden	1,582	1,187,765	1,993	1,582,746
Norway	1,517	866,001	4,280	3,007,900
Denmark	1,365	938,065	1,802	1,448,549
Germany	3,009	2,774,073	2,087	2,181,319
Netherlands	691	479,126	609	557,051
Belgium	702	604,965	132	129,630
France	6,633	4,793,196	1,837	1,295,200
Portugal	661	559,304	—	—
Spain	1,238	1,226,778	986	1,372,418
Italy	2,258	4,071,225	454	902,693
Austria-Hungary	253	553,581	286	645,344
Greece	193	348,448	533	1,003,029
Bulgaria	17	36,043	—	—
Roumania	81	160,085	—	—
Turkey	108	198,163	—	—
Rest of Europe & Mediterranean Coasts of Africa and Asia	720	855,368	—	—
Total Europe and Mediterranean Coasts of Africa & Asia	22,433	21,073,235	15,421	14,553,711
United Kingdom	Nil	Nil	10,635	14,021,408
British Possessions	916	1,406,990	—	—
Egypt	548	1,276,037	—	—
Argentine Republic	769	1,790,498	—	—
Brazil	465	1,073,427	—	—
Uruguay	165	359,939	—	—
Chile	198	476,709	—	—
Canary Islands and Madeira	339	561,074	—	—
Africa	168	296,541	—	—
Asia	74	236,914	—	—
United States of America	60	111,373	1	3,324
Rest of American Continent and Islands	55	87,626	—	—
Other Foreign Countries	—	—	133	171,920
	3,757	7,677,128	10,769	14,196,652
Grand Total	26,190	28,750,363	26,190	28,750,363

DIAGRAM A.

Showing Entrances and Clearances with Cargoes in the Foreign Trade of the United Kingdom, 1913 and 1919.

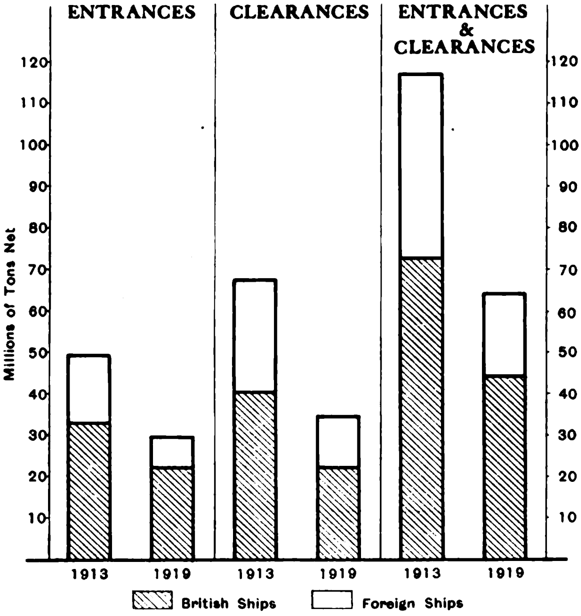


DIAGRAM B.

Trade of British Coal-Shipping Centres, 1913. (I) Tonnage of Vessels cleared with Cargoes to British Possessions and Foreign Countries; (II) Nationality of those Vessels.

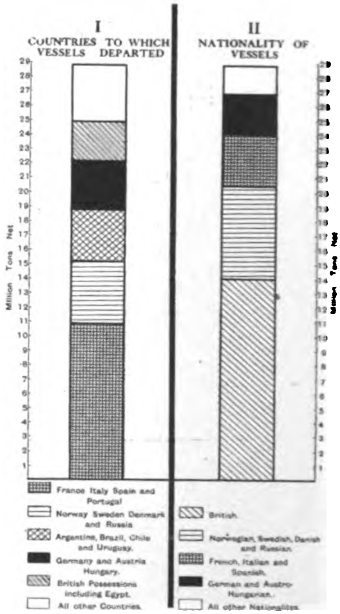


DIAGRAM C.

Net Tonnage and Nationalities of Vessels passed through Suez Canal, 1913 and 1919.

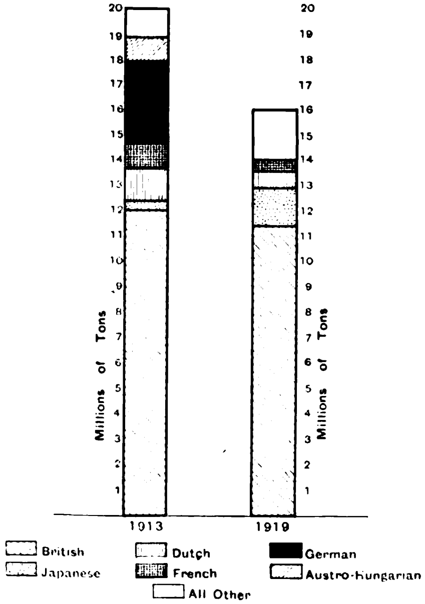
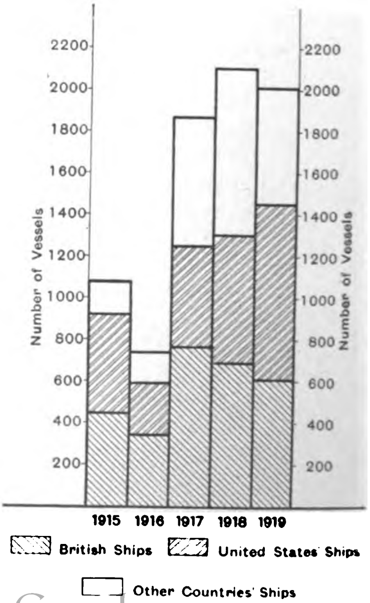


DIAGRAM D.

Number and Nationalities of Vessels passed through Panama Canal, 1915–1919.



STATEMENT SHOWING THE NATIONALITY AND NET TONNAGE OF VESSELS WHICH ENTERED AND CLEARED WITH CARGOES AND IN BALLAST IN THE FOREIGN TRADE OF THE UNITED STATES OF AMERICA FOR THE YEARS ENDED 30TH JUNE, 1913 AND 1918.

(*See diagram, page* 348.)

Nationality.	Entrances.		Clearances.		Percentages.			
					Entrances.		Clearances.	
	1913.	1918.	1913.	1918.	1913.	1918.	1913.	1918.
	Tons.*	Tons.*	Tons.*	Tons.*				
American	13,073	18,460	13,946	18,761	25·8	42·0	27·3	41·7
British	24,532	17,871	24,289	18,498	48 5	40·7	47 5	41·1
Other Nationalities :—								
Austrian	438	—	424	—	0·9	—	0·8	—
Belgian	352	256	356	280	0·7	0·6	0·7	0·6
Danish	481	900	446	929	0·9	2·0	0·9	2·1
Dutch	1,049	317	1,077	308	2·1	0·7	2·1	0·7
French	1,027	713	1,034	752	2·0	1·6	2·0	1·7
German	4,578	—	4,587	—	9·0	—	9·0	—
Italian	838	607	802	651	1·7	1·4	1·6	1·4
Norwegian . . .	2,774	2,026	2,798	2,074	5·5	4·6	5·5	4·6
Portuguese . . .	14	92	15	103	—	0·2	—	0·2
Russian	130	74	130	64	0·2	0·2	0·2	0·1
Spanish	391	297	374	338	0·8	0·7	0·7	0·8
Swedish	60	378	65	398	0·1	0·9	0·1	0·9
Japanese	394	1,301	287	1,153	0·8	3·0	0·6	2·6
All other Nationalities	510	619	523	662	1·0	1·4	1·0	1·5
Total . . .	50,639*	43,912*	51,152*	44,971*	100·0	100·0	100·0	100·0

	Entrances and Clearances.			Percentage of Total		Percentage. Increase or Decrease.
	1913.	1918.	Difference.	1913.	1918.	
	Tons.*	Tons.*	Tons.*			
American	27,018	37,221	Increase 10,202	27	42	Increase 38
British	48,821	36,369	Decrease 12,452	48	41	Decrease 26
Other Nationalities .	26,952	15,293	Decrease 10,659	25	17	Decrease 41
Total . . .	101,791*	88,883*	Decrease 12,908*	100	100	Decrease 13

* *Figures in thousands*, i.e. *hundreds omitted.*

PROPORTION OF U.S.A. EXPORTS CARRIED IN BRITISH, AMERICAN, AND OTHER VESSELS, AS SHOWN BY THE CLEARANCES WITH CARGOES IN THE OVERSEAS TRADE OF THE UNITED STATES OF AMERICA. (*See diagram, page* 348.)

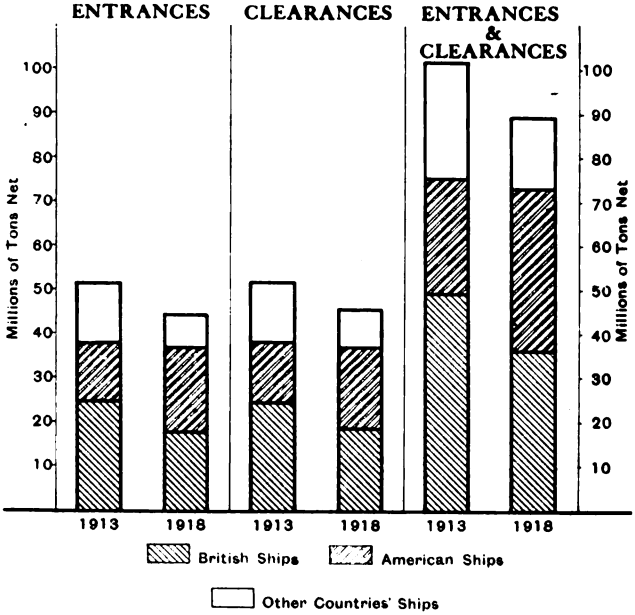
	Clearances with Cargoes.			
—	1913.	Percentage 1913.	1918.	Percentage 1918.
	Net Tons.		Net Tons.	
British Vessels	21,825,638	49	16,998,269	45
American Vessels	10,917,760	25	13,596,241	36
All other Vessels	11,739,449	26	7,148,007	19
Total Clearances with Cargoes .	44,482,847	100	37,742,517	100

PERCENTAGE OF UNITED STATES IMPORTS AND EXPORTS CARRIED IN AMERICAN VESSELS.

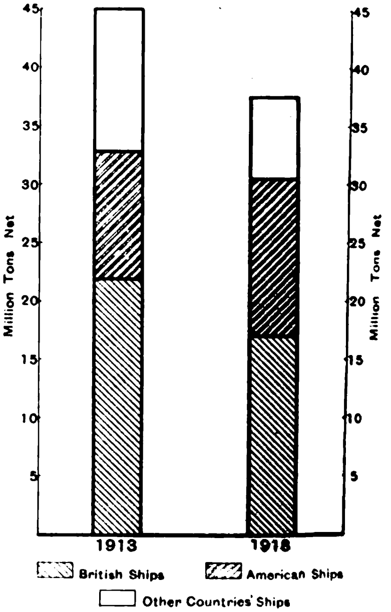
(By Ten-Year Periods Generally.)

Fiscal Year.	By Sea (including all Great Lakes water-borne foreign Commerce).				By Land Vehicles.	Total by Land and Sea.
	In American Vessels.	In Foreign Vessels.	Total.	Per cent. American Vessels.		
	$	$	$		$	$
1821	113,210,462	14,358,235	127,559,679	88·7	—	—
1830	129,918,458	14,447,970	144,366,428	89·9	—	—
1840	198,424,609	40,802,856	239,227,465	82·9	—	—
1850	230,272,084	90,764,954	330,037,038	72·5	—	—
1860	507,247,757	255,040,793	762,288,550	66·5	—	—
1870	352,969,401	638,927,488	991,896.889	35·6	—	991,896,889
1880	258,346,577	1,244,265,433	1,482,612,011	17·4	20,981,393	1,503,593,404
1890	202,451,086	1,371,116,744	1,573,567,830	12·9	73,571,263	1,647,139,093
1900	195,084,192	1,894,444.424	2,089,528,616	9·3	154,895,650	2,224,424,266
1910	260,837,147	2,721,962,475	2,982,799,622	8·7	319,132,528	3,301,932,150
1913	381,032,496	3,392,028,429	3,773,060,925	10·1	505,831,459	4,278,892,384
1914	368,359,756	3,417,108,756	3,785,468,512	9·7	473,036,293	4,258,504,805
1915	571,931,912	2,420,693,563	3,992,625,475	14·3	450,133,605	4,442,759,080
1916	948,908,216	4,877,132,995	5,826,041,211	16·3	705,325,184	6,531,366,395
1917	1,452,086,468	6,367,408,665	7,819,495,133	18·6	1,129,908,446	8,949,403,579
1918	1,688,495,946	6,015,204,510	7,703,700,456	21·9	1,161,666,318	8,865,366,774
1919	2,492,840,480	6,459,712,322	8,952,552,802	27·8	1,138,408,037	10,320,960,839

Diagram showing Entrances and Clearances with Cargoes and in Ballast of British, American, and other Vessels in the Foreign Overseas Trade of the United States, 1913 and 1918.



Proportion of U.S. Seaborne Exports carried in British, American, and other Vessels, 1913 and 1918.



FOREIGN TRADE OF THE UNITED STATES OF AMERICA.

1913 AND 1918.

—	Imports.		Exports.		Imports and Exports.		Percentage of Total Imports.		Percentage of Total Exports.		Percentage of Total Imports and Exports.	
	1913.	1918.	1913.	1918.	1913.	1918.	1913.	1918.	1913.	1918.	1913.	1918.
	Million $.	Million $.	Million $.	Million $.	Million $.	Million $.						
Overland	115.3	385.2	390.5	776.4	505.8	1161.6	6·4	13·1	15·8	13·1	11·8	13·1
Oversea—												
In American vessels . .	193.1	710.8	187.9	977.7	381.0	1688.5	10·6	24·1	7·6	16·5	8·9	19·0
In Foreign vessels	1504.6	1849.6	1887.5	4165.6	3392.1	6015.2	83·0	62·8	76·6	70·4	79·3	67·9
Total Oversea . .	1697.7	2560.4	2075.4	5143.3	3773.1	7703.7	93·6	86·9	84·2	86·9	88·2	86·9
Grand Total . .	1813.0	2945.6	2465.9	5919.7	4278.9	8865.3	100·0	100·0	100·0	100·0	100·0	100·0

FOREIGN TRADE OF THE UNITED STATES OF AMERICA.

Statement showing the Entrances and Clearances in the Foreign Trade of the United States of America for the Years 1913 and 1919.

Nationality of Vessels.	Entrances.		Clearances.		Entrances and Clearances.		Percentages.					
							Entrances.		Clearances.		Entrances and Clearances.	
	1913	1919.	1913.	1919.	1913.	1919.	1913.	1919.	1913.	1919.	1913.	1919.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.						
American . . .	13,072,567	21,932,662	13,945,801	24.992,076	27,018,368	46,924,738	25·8	47·0	27·3	48·8	26·5	47·9
Foreign . . .	37,566,606	24,769,012	37,206,158	26,264,575	74,772,764	51,033,587	74·2	53·0	72·7	51·2	73·5	52·1
Total . .	50,639,173	46,701,674	51,151,959	51,256,651	101,791,132	97,958,325	100·0	100·0	100·0	100·0	100·0	100·0

TECHNICAL SOCIETIES DEALING WITH NAVAL ARCHITECTURE AND KINDRED SUBJECTS.

Civil Engineers, Institution of: President, Sir J. P. Griffith: Secretary, Dr. J. H. T. Tudsbery; Address, Great George Street, Westminster, London, S.W. 1.

Mechanical Engineers, Institution of: President, Capt. H. Riall Sankey; Secretary, Brig. Gen. Mowat; Address, Storey's Gate, St. James Park, London, S.W. 1.

Iron and Steel Institute: President, Dr. J. E. Stead: Secretary, Mr. G. C. Lloyd; Address, 28, Victoria Street, Westminster, London, S.W. 1.

Electrical Engineers, Institution of: President, Mr. L. B. Atkinson; Secretary, Mr. P. F. Rowell; Temporary Address, 1, Albemarle Street, London, W. 1.

Naval Architects, Institution of: President, Earl of Durham; Secretary, Mr. R. W. Dana; Address, 5, Adelphi Terrace, London, W.C. 2.

Marine Engineers, Institute of: President, Lord Weir of Eastwood; Secretary, Mr. J. Adamson; Address, 85–88, Minories, London, E. 1.

Metals, Institute of: President, Engineer Vice-Admiral Sir George Goodwin; Secretary, Mr. G. Shaw Scott; Address, 36, Victoria Street, Westminster, London, S.W. 1.

Engineers, Society of: President, Mr. Bernard Geen; Secretary, Mr. A. S. E. Ackermann; Address, 17, Victoria Street, Westminster, London, S.W. 1.

Junior Institution of Engineers: President, Lord Weir of Eastwood: Secretary, Mr. H. G. Riddle; Address, 39, Victoria Street, Westminster, London, S.W. 1.

Nautical Research, Society for: President, Marquess of Milford Haven; Secretary, Col. W. G. Simpson; Address, United Service Club, Pall Mall, London, S.W. 1.

Navy Records Society: President, Lord George Hamilton; Secretary, Mr. W. G. Perrin; Address, Admiralty, London, S.W. 1.

North-East Coast Institution of Engineers and Shipbuilders: President, Mr. A. E. Doxford; Secretary, Mr. E. W. Fraser Smith; Address, Bolbec Hall, Newcastle-on-Tyne.

Liverpool Engineering Society: President, Lieut.-Col. J. R. Davidson; Secretary, Mr. T. R. Wilton; Address, Westminster Chambers, 1, Crosshall Street, Liverpool.

Manchester Association of Engineers: President, Mr. Henry Pilling; Secretary, Mr. F. Hazelton; Address, 120, Portland Street, Manchester.

Engineers and Shipbuilders in Scotland, Institution of: President, Dr. T. Blackwood; Secretary, Mr. E. H. Parker; Address, Elmbank Crescent, Glasgow.

Civil Engineers of Ireland, Institution of: President, Mr. Francis Bergin; Secretary, Mr. J. H. Hargrave; Address, 35, Dawson Street, Dublin.

Belfast Association of Engineers: President, Mr. W. Walker; Secretary, Mr. H. Fildes; Address, 20, Wilmont Terrace, Belfast.

SHIPPING ORGANISATIONS.

Trinity House; H.R.H. Duke of Connaught, Master; Captain Sir H. Acton Blake, K.C.M.G., Deputy-Master; Mr. H. G. Willett, Secretary, Tower Hill, E.C. 3.

Chamber of Shipping of the United Kingdom; Mr. W. J. Noble, President; Sir Owen Philipps, G.C.M.G., M.P., Vice-President; Mr. H. M. Cleminson, General Manager, 28, St. Mary Axe, E.C. 3.

Shipowners' Parliamentary Committee; Sir Shadforth Watts, Chairman; Sir Thomas Royden, Bt., C.H., M.P., Vice-Chairman; Mr. H. M. Cleminson, Secretary, 28, St. Mary Axe, E.C. 3.

Shipping Federation, Ltd.; Sir Shadforth Watts, Chairman; Mr. Cuthbert Laws, General Manager; Mr. Michael Brett, Secretary, 24, St. Mary Axe, E.C. 3.

Liverpool Steamship Owners' Association; Colonel H. Concannon, O.B.E., Chairman; Mr. David Jones, Vice-Chairman; Sir Norman Hill, Bt., Secretary; Mr. F. Russell Roberts, Assistant Secretary, 10, Water Street, Liverpool.

Lloyds; Mr. Sidney A. Boulton, Chairman; Rear-Admiral Sir Edward F. Inglefield, Secretary, Royal Exchange, E.C. 3.

Lloyds' Register of Shipping; Sir Thomas L. Devitt, Bt., Chairman; Mr. Andrew Scott, Secretary; Sir Westcott Abell, Chief Surveyor; Mr. J. T. Milton, Chief Engineer, 71, Fenchurch Street, E.C. 3.

Baltic Mercantile and Shipping Exchange; Mr. Charles W. Howard, Chairman; Mr. J. A. Findlay, Secretary, St. Mary Axe, E.C. 3.

British Corporation for the Survey and Registry of Shipping; Mr. Robert Clark, Chairman; Mr. John Fleming, Secretary; Mr. J. Foster King, Chief Surveyor, 14, Blytheswood Square, Glasgow.

Liverpool Steamship Owners' Association; Colonel H. Concannon, O.B.E., Chairman; Mr. David Jones, Vice-Chairman; Sir Norman Hill, Bt., Secretary; Mr. F. Russell Roberts, Assistant Secretary, 10, Water Street, Liverpool.

London General Shipowners' Society; Mr. Howard Houlder, Chairman; Mr. D. T. Garrett, Secretary, 5, Whittington Avenue, E.C. 3.

Britannia Steamship Insurance Association; Mr. Douglas W. Stobart, Chairman; Messrs. Tindall Riley & Co., Managers, 17, Gracechurch Street, E.C. 3.

British Shipowners' Mutual Protection and Indemnity Association, Ltd.; Mr. O. H. Pollak, Chairman; Messrs. A. Bilbrough & Co., Managers, 23, Rood Lane, E.C. 3.

London Steamship Owners' Mutual Insurance Association, Ltd.; Mr. Howard Houlder, Chairman; Messrs. A. Bilbrough & Co., Managers, 23, Rood Lane, E.C. 3.

Standard Steam Shipowners' Protection and Indemnity Association; Mr. Charles T. Milburn, Chairman; Messrs. Charles Taylor & Co., Managers, 9, Fenchurch Avenue, E.C. 3.

United Kingdom Mutual Steamship Association; Sir Walter Runciman, Bt., Chairman; Messrs. T. R. Miller & Son, Managers, 24, St. Mary Axe, E.C. 3.

West of England Steamship Owners' Protection and Indemnity Association, Ltd.; Sir Shadforth Watts, Chairman; Sir John B. Wimble, Vice-Chairman; Messrs. John Holman & Sons, Managers, 1, Lloyd's Avenue, E.C. 3.

Liverpool Shipowners' Association; Mr. Ernest Cook, Chairman; Messrs. Weightman Pedder & Co., Secretaries, 18, Water Street, Liverpool.

Manchester Steamship Owners' Association; Mr. W. J. Worthington, Chairman; Mr. T. Whyman, Secretary, 115, Corn Exchange Buildings, Manchester.

Hull Incorporated Chamber of Commerce and Shipping (Shipping Section); Capt. H. Samman; Mr. A. Whitehead, Secretary, Chamber of Commerce, Hull.

North of England Steamship Owners' Association; Mr. R. S. Dalgleish, Chairman; Mr. William T. Todd, Secretary, 6, Sandhill, Newcastle-on-Tyne.

North of England Protecting and Indemnity Association; Mr. M. McNaughtan Mein, Chairman; Sir Wiliam Seager, M.P., Vice-Chairman; Mr. J. Stanley Todd and Mr. Frederick Miller, Managers, Collingwood Buildings, Newcastle-on-Tyne.

Newcastle Protection and Indemnity Association; Sir Walter Runciman, Bt., Chairman; Mr. Jas. Ferguson, Secretary, 4, Queen Street, Newcastle-on-Tyne.

Hartlepool Shipowners' Society; Lt.-Com. J. H. Ropner, Chairman; Mr. William Allen, Secretary, West Hartlepool.

Sailing Shipowners' Association; Mr. J. W. Eason, Chairman of the Executive Committee; Mr. H. M. Cleminson, Secretary, 24, St. Mary Axe, E.C. 3.

Sunderland Shipowners' Society; Mr. Chas. Booth, Secretary, 44, Frederick Street, Sunderland.

Cardiff and Bristol Channel Incorporated Shipowners' Association; Mr. T. H. Mordey, Chairman; Mr. W. R. Hawkins, Secretary, Exchange Buildings, Cardiff.

Swansea Chamber of Commerce and Shipping (Shipping Section); Mr. W. Turpin, Chairman; Mr. Henry J. Marshall, Secretary, Chamber of Commerce, Swansea.

Bristol Steamship Owners' Association; Mr. C. Gaythorne Hill, Chairman; Mr. A. S. Ray, Hon. Secretary, 18, St. Augustine's Parade, Bristol.

Newport Shipowners' Association; Mr. E. L. Melville Heard, Chairman; Mr. Griffith J. Jones, Secretary, Newport, Mon.

Leith Shipowners' Association; Mr. James Currie, Chairman; Mr. James Cormack, Secretary, 7, John's Place, Leith.

Glasgow Shipowners' Association; Mr. W. S. Workman, Chairman; Mr. Jas. A. Mackenzie, Secretary, 150, St. Vincent Street, Glasgow.

Clyde Steamship Owners' Association; Mr. W. F. Robertson, President; Mr. Walter Patterson, Secretary, 94, Hope Street, Glasgow.

Clyde Sailing Shipowners' Association, Ltd.; Colonel George Milne, C.B., Chairman; Mr. Walter Patterson, Secretary, 94, Hope Street, Glasgow.

Shipping Federation, Clyde District; Mr. R. J. Dunlop, Chairman; Mr. Walter Patterson, Secretary, 94, Hope Street, Glasgow.

Belfast Shipowners' Association; Mr. J. A. M. Heyn, Secretary, Belfast.

LIST OF PRINCIPAL BRITISH AND FOREIGN SHIPOWNERS.

Adelaide Steamship Co., Ltd., Currie St., Adelaide, South Australia; Yuills, Ltd., 120, Fenchurch St., London, E.C. 3.
African Steamship Co., Colonial House, Water St., Liverpool.
Alaska S.S. Co., Pier 2, Seattle, Wash., U.S.A.
Allan Line, 25, Bothwell St., Glasgow.
American-Hawaiian Steamship Co., 8, Bridge St., New York, U.S.A.
American Line. *See* International Mercantile Marine Co., of New Jersey, and International Navigation Co., Ltd.
Anchor Line, 12 and 16, St. Vincent Place, Glasgow.
Anglo-American Oil Co., Ltd., 36, Queen Anne's Gate, Westminster, London, S.W. 1.
Anglo-Saxon Petroleum Co., Ltd., St. Helen's Court, Great St. Helen's, London, E.C. 3.
Asiatic Steam Navigation Co., Ltd., 45, St. Mary Axe, London, E.C. 3.
Atlantic, Gulf & West Indies Steamship Lines, 11, Broadway, New York, U.S.A.
Atlantic Transport Line, 38, Leadenhall St., London, E.C. 3.
Australasian United Steam Navigation Co., Ltd., 120, Leadenhall St., London, E.C. 3.
Australian Steamships, Ltd., 35–45, Market St., Melbourne, and 33, Cornhill, London E.C. 3.
Beatley & Son, T. G., 99, Fenchurch St., E.C. 3.
Belfast SS. Co., Ltd., 42 & 43, Donegall Quay, Belfast.
Bell & Co., James, Fleet Chambers, Jameson St., Hull.
Ben Line, 28, Bernard St., Leith.
Bergenske Dampskibsselskab. Det, Bergen, Norway.
Bibby Line, 26, Chapel St., Liverpool.
Blue Funnel Line. *See* Holt, Alfred, & Co.
Blue Star Line, Ltd., Holland House, Bury St., London, E.C. 3.
Bombay Steam Navigation Co., Ltd., 120, Frere Road, Bombay.
Booth Line, Cunard Building, Liverpool.
Bowring, C. T., & Co., Ltd., 20, Castle St., Liverpool, and Winchesrer House, Old Broad St., London, E.C. 3.
British India Line, 122, Leadenhall St., London, E.C. 3.
British Petroleum Co., Ltd., 22, Fenchurch St., London, E.C. 3.
British Tanker Co., Ltd., Britannic House, 23, Great Winchester St., London, E.C. 2.
Brocklebank, T. & J., Ltd. (Anchor-Brocklebank & Well Lines), Cunard Building, Liverpool.
Brodin, Erik, Stockholm, Sweden.
Broström, Dan, Gothenberg, Sweden.
Bull & Co., A. H., 17, Battery Place, New York.
Burns, G. & J., Ltd., 30, Jamaica St., Glasgow.
Cairns, Noble & Co., Akenside House, Newcastle-on-Tyne.
Canadian Pacific Ocean Services, Ltd., 8, Waterloo Place, Pall Mall, London, S.W. 1.
Canadian Pacific Railway Co., Montreal.
Canadian Steamship Lines, Ltd., 9–11, Victoria Square, Montreal.
Carlsson, G., Gothenberg, Sweden.
Chambers & Co., James, 3 & 5, King St., Liverpool.
Chargeurs Réunis, Cie. Française de Navigation à Vapeur, 1, Boulevard Malesherbes, Paris.
Chellew, R. B., Exchange Buildings, Truro, Cornwall.
China Navigation Co., Ltd., 8, Billiter Square, London, E.C. 3.
City Line (Ellerman Lines, Ltd.), 75, Bothwell St., Glasgow.
Clan Line (Cayzer Irvine & Co.), 2, St. Mary Axe, London, E.C. 3.
Clarke (Stephenson) & Co., 4, St. Dunstan's Alley, E.C. 3.
Cleveland Cliffs Iron Co., 11th Floor, Rockefeller Building, Cleveland, Ohio, U.S.A.

Clyde Shipping Co., Ltd., 21, Carlton Place, Glasgow.
Clyde Steam Ship Co., Pier 36, North River, New York.
Coast Lines, Ltd., 22, Water St., Liverpool.
Commonwealth & Dominion Line, Ltd., 9 & 11, Fenchurch Avenue, London, E.C. 3.
Commonwealth Government Line of Steamers, Australia House, Strand, London, W.C. 2.
Compagnie Générale Transatlantique, 6, Rue Auber, Paris, and 8, Lloyd's Avenue, London, E.C. 3.
Compagnie Havraise Péninsulaire de Navigation à Vapeur, 10, Rue de Châteaudun Paris.
Compañia Transatlantica, Cadiz.
Cory Colliers, Ltd., 52, Mark Lane, E.C. 3.
Cory, John, & Sons, Ltd., Mount Stuart House, Cardiff.
Cunard Line, Cunard Building, Pier Head, Liverpool.
Dalgliesh, R. S., Ltd., Watergate Buildings, Sandhill, Newcastle-upon-Tyne.
Dampskibsactieselskabet Otto Thoresens Linie, Prinsengade 1, Christiania.
Det Forenede Dampskibs-Selskab, Kvaesthusgade 7 and 9B, Copenhagen, Denmark.
Dominion Line (British & North Atlantic Steam Navigation Co., Ltd.), 30, James St., Liverpool.
"Donaldson" Line, Ltd., 14, St. Vincent Place, Glasgow.
Eagle Oil Transport Co., Ltd., 16, Finsbury Circus, London, E.C. 2.
East Asiatic Co., Ltd. (United Baltic Corp., Ltd., 158, Fenchurch St., London, E.C. 3), 2, Holbergsgade, Copenhagen, Denmark.
Edwards, E., & Sons, Ltd., Managers, Western Counties Shipping Co., Ltd., Bute St., Pierhead Chambers, Cardiff.
Elder Dempster & Co., Ltd., Colonial House, Water St., Liverpool.
Ellerman & Bucknall Steamship Co., Ltd., 5 & 6, Billiter Avenue, London, E.C. 3.
Ellerman Lines, Ltd., 22, Water St., Liverpool.
Ellerman's Wilson Line, Hull.
Federal Steam Navigation Co., Ltd., 2, Fenchurch Avenue, London, E.C. 3.
Fenwick, Wm. France, & Co., Ltd., 5, Fenchurch St., E.C. 3.
Finland Line, Helsingfors.
Fisher, Alimonda & Co., Ltd., 112, Fenchurch St., London, E.C. 3.
Furness, Withy & Co., Ltd., Furness House, Billiter St., London, E.C. 3.
General Steam Navigation Co., Ltd., 15, Trinity Square, London, E.C. 3.
Glen Line, Ltd., 1, East India Avenue, London, E.C. 3.
Gould, J. C., & Co. (Steamship Managers), Ltd., Merthyr House, Cardiff.
Gow, Harrison & Co., 8, Gordon St., Glasgow.
Grace, W. R., & Co., 1, Hanover Square, New York, U.S.A.
Hain, Edward, & Son, Ltd., St. Ives, Cornwall.
Hall Line, Tower Building, Water St., Liverpool.
Hamburg-Amerikanische Packetfahrt Actien-Gesellschaft, Alsterdamm 25, and Ferdinandstrasse 58/62, Hamburg, Germany.
Hansen, C. K., 15, Toldbodvejen, Copenhagen.
Harrison Line, Mersey Chambers, Old Churchyard, Liverpool.
"Head" Line & "Lord" Line, Ulster Steamship Co., Ltd., Head Line Building, Belfast.
Henderson, P., & Co., 15, St. Vincent Place, Glasgow.
Hogarth, H., & Sons, 24, St. Enoch Square, Glasgow.
Holland-America Line, Rotterdam, Holland.
Holt, Alfred, & Co. (Blue Funnel Line), India Buildings, Water St., Liverpool.
Houlder Bros. & Co., Ltd., 146, Leadenhall St., London, E.C. 3.
Houlder, Middleton & Co., Ltd., 17, St. Helens Place, E.C. 3.
Houston Lines, 10, Dale St., Liverpool.
Huddart, Parker, Ltd., 466, Collins St., Melbourne, and 101, Leadenhall St., London, E.C. 3.
Indo-China Steam Navigation Co., Ltd., Hong Kong and 3, Lombard St., London, E.C. 3.
Instone, S., & Co., Ltd., Baltic House, Docks, Cardiff.
International Mercantile Marine Co., of New Jersey, Canute Road, Southampton.
International Navigation Co., Ltd., 30, James St., Liverpool.
Java-China-Japan Lijn, Prins Hendrikkade 34, Amsterdam.
Johnson, Axel Axelson, Stockholm.
Johnston Line, Ltd., Royal Liver Building, Liverpool.
Kawasaki Dockyard Co., Ltd., Kobe, Japan.
Koninklijke Hollandsche Lloyd, Prins Hendrikkade, Amsterdam, Holland.
Koninklijke Nederlandsche Stoomboot Maatschappij, Scheepvaarthuis, Prins Hendrikkade 108-114, Amsterdam, Holland.

Koninklijke Paketvaart Maatschappij, 112–114, Prins Hendrikkade, Amsterdam, Holland.
Lamport & Holt, Ltd., Royal Liver Building, Pier Head, Liverpool.
Lang & Fulton, Ltd., 1, Cathcart St., Greenock.
Larrinaga & Co., Ltd., 30, James St., Liverpool.
Leith, Hull & Hamburg Steam Packet Co., Ltd., 16, Bernard St., Leith.
Leyland Line, 27 & 29, James St., Liverpool.
Lloyd Brazileiro, Praça Servulo Dourado, Rio de Janeiro, Brazil.
Lloyd Royal Belge (Great Britain), Ltd., 101, Leadenhall St., London, E.C. 3.
Lloyd Triestino Soc. Di Nav. a Vapore, Del, Trieste, Italy.
"Lord" Line. *See* "Head" Line.
MacAndrews & Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C. 4.
MacBrayne, Ltd., David, 119, Hope St., Glasgow.
Maclay & McIntyre, 21, Bothwell St., Glasgow.
Mallory Steamship Co., Pier 36, North River, New York, U.S.A.
Manchester Liners, Ltd., 108, Deansgate, Manchester.
McIllwraith, McEacharn's Line, Ltd., Scottish House, 94, William St., Melbourne, and Billiter Square Buildings, London, E.C. 3.
Méssageries Maritimes, Cie. des, 8, Rue Vignon, Paris.
Mitsui Bussan Kaisha, Ltd. (Mitsui & Co., Ltd.), 1, Surugacho, Nihonbashi-Ku, Tokyo, Japan.
Moss & Co., H. E., 18, Chapel St., Liverpool.
Navigazione Generale Italiana, 6, Via Balbi, Genoa; Italian State Railways, 12, Waterloo Place, Regent St., London, S.W. 1.
"Nederland" Stoomvaart Maatschappij, 108/114, Prins Hendrikkade, Amsterdam.
Nelson, H. & W., Ltd., 98, Leadenhall St., London, E.C. 3.
New York & Cuba Mail S.S. Co. (Ward Line), Foot of Wall St., New York, U.S.A.
New York & Porto Rico S.S. Co., 11, Broadway, New York, U.S.A.
New Zealand Shipping Co., Ltd., Wellington, N.Z., and 138, Leadenhall St., London, E.C. 3.
Nippon Yusen Kabushiki Kaisha, 1, Yurakucho Itchome, Kojimachi-Ku, Tokyo, and Coronation House, Lloyd's Avenue, London, E.C. 3.
Nisshin Kisen Kabushiki Kaisha, 1, Yurakucho Itchome, Kojimachi-Ku, Tokyo, Japan.
Nordenfjeldske Dampskibs-Selskab, Det, Trondhjem, Norway.
Norddeutscher Lloyd, Bremen, Germany.
Norske Amerika Linie A/S., Den, Strandgaten 1, Christiania, Norway.
North Coast Steam Nav. Co., Ltd., 3, Sussex St. North, Sydney, N.S.W.
Orient Line to Australia, 5, Fenchurch Avenue, London, E.C. 3.
Osaka Shosen Kabushiki Kaisha, 64, Tomijimacho, Kitaku, Osaka, Japan.
Pacific Steam Navigation Co., Goree, Water St., Liverpool.
Pacific Steamship Co., L. C. Smith Building, Seattle, U.S.A.
Pan American Petroleum & Transport Co., 1015, Security Building, Los Angeles, Cal., U.S.A.
Panama Railroad Co., 24, State St., New York.
Pelton S.S. Co., Ltd., Milburn House, Newcastle-on-Tyne.
Peninsular & Oriental Steam Navigation Co., Inc., 122, Leadenhall St., London, E.C. 3.
P. & O. Branch Line, 32, Lime St., E.C. 3.
Petersen & Co., Ltd., 6, Lloyd's Ave., E.C. 3.
Pinillos, Irzquierdo & Co., Cadiz.
Prince Line, Ltd., 12, Leadenhall St., London, E.C. 3.
Radcliffe & Co., Evan Thomas, Baltic House, Cardiff.
Raeburn & Vérel, Ltd., 45, West Nile St., Glasgow.
Red Star Line, 22, Rue des Peignes, Antwerp, Holland.
Ridley, Son & Tully, John, Milburn House, Newcastle-on-Tyne.
Rio Cape Line, Ltd., 12, Leadenhall St., London, E.C. 3.
Robertson, Wm., 45, West Nile St., Glasgow.
Ropner, Sir R., & Co., Ltd., Mercantile Chambers, Mainsforth Terrace, West Hartlepool.
Royal Mail Steam Packet Co., 18, Moorgate St., London, E.C. 2.
Russian Volunteer Fleet, Theodosia Crimea, and 28, Fenchurch St., London, E.C. 3.
Ruys, Wm., & Zonen, Veerhaven, 7, Rotterdam, Holland.
Salvesen & Co., Chas., 29, Bernard St., Leith.
Shaw, Savill & Albion Co., Ltd., 34, Leadenhall St., London, E.C. 3.
Smith, W. R., & Sons, Merthyr House, James St., Cardiff.
Società di Navigazione "Sicilia," Via del Giardino 76, Rome.
Società Italiana di Servizi Marittimi, Piazza Venezia 11, Rome.

Société Générale d'Armement, 1, Place Graslin, Nantes, France.
Société Générale de Transports Maritimes à Vapeur, 8, Rue Ménars, Paris.
Société Navale de l'Ouest, 8, Rue Auber, Paris.
Sota & Aznar, Bilbao, Spain, and 1, Lloyd's Avenue, London, E.C. 3.
Souter, W. A., & Co., Akenside House, Newcastle-on-Tyne.
Southern Pacific Co., Atlantic Steamship Lines, 165, Broadway, New York, U.S.A.
Standard Transportation Co., 26, Broadway, New York, U.S.A.
Standard Transportation Co., Ltd., Hong Kong.
Stern, J., 15, Rue Scribe, Paris.
Stockholms Rederiaktiebolag Svea., Skeppsbron 30, Stockholm, Sweden.
Straits Steamship Co., Ltd., St. Helen's Court, Collyer Quay, Singapore.
Strick, Frank C., & Co., Ltd., Baltic House, Leadenhall St., London, E.C. 3.
Sun Shipping Co., 8, St. Helen's Place, E.C. 3.
Tatsuuma Kisen Kabushiki Kaisha (Tatsuuma S.S. Co.), Nishinomiya, near Kobe, Japan.
Thompson, Geo., & Co., Ltd., 7, Billiter Square, E.C. 3.
Tilbury Contracting & Dredging Co., Ltd., Queen Anne's Chambers, Westminster, S.W. 1.
Toyo Kisen Kabushiki Kaisha (Oriental S.S. Co., Ltd.), No. 1, 1-chome Eirakucho, Kojimachi-Ku, Tokyo, Japan.
Transport & Trading Co., Ltd., 16/17, Gt. St. Helens, E.C. 3.
Turner, Brightman & Co., 8 & 9, Gt. St. Helens, E.C. 3.
Union-Castle Line, 3 & 4, Fenchurch St., London, E.C. 3.
Union Steamship Co. of Zealand, Ltd., Dunedin, N.Z., and 138, Leadenhall St., London, E.C. 3.
United States Steel Products Co., 30, Church St., New York.
Walford (London) Ltd., Leopold, 29, Great St. Helens, E.C. 3.
Watts, Watts & Co., Ltd., 7, Whittington Avenue, Leadenhall St., London, E.C. 3.
Weir, Andrew, & Co., Baltic Exchange Buildings, 19, 20, 21, Bury St., London, E.C. 3.
Westall, James, 13, John St., Sunderland.
Western Counties Shipping Co., Ltd. (see Edwards, E., & Sons, Ltd.).
White Star Line, 30, James St., Liverpool.
Wilson Transit Co., 948, Rockefeller Building, Cleveland, Ohio, U.S.A.
Witherington & Everett, Exchange Buildings, Quayside, Newcastle-on-Tyne.
Ybarra & Co., Calle San José 5, Seville, Spain.

LIST OF THE PRINCIPAL BRITISH SHIPBUILDERS, MARINE ENGINEERS, AND REPAIRERS.

(*Showing in brackets after their names the output of each for* 1919.)

Ailsa Shipbuilding Co., Ltd., Troon and Ayr (14 vessels, 7232 tons, 13,615 I.H.P.).
Alley and M'Lellan, Glasgow (15 vessels, 2650 tons).
Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan (11 vessels, 9958 tons).
Armstrong, Whitworth and Co., Ltd., Sir W. G., Newcastle-on-Tyne (11 vessels, 43,250 tons, 14,800 I.H.P.).
Austin, S. P., and Co., Ltd., Sunderland (3 vessels, 6694 tons).
Ayrshire Dockyard Co., Ltd., Irvine (6 vessels, 18,789 tons).
Babcock and Wilcox, Ltd., Glasgow (52,500 I.H.P.).
Barclay, Curle and Co., Ltd., Glasgow (7 vessels, 54,903 tons, 53,000 I.H.P.).
Beardmore, W. and Co., Ltd., Dalmuir (9 vessels, 33,520 tons, 127,670 I.H.P.).
Bergius Co., Glasgow (18,127 I.H.P.).
Bertram and Sons, Ltd., Sunderland (3 vessels, 15,360 tons).
Blair and Co., Ltd., Stockton (49,650 I.H.P.).
Blumer, J. and Co., Sunderland (4 vessels, 12,224 tons).
Blyth S. B. and D. D. Co., Ltd., Blyth (4 vessels, 12,204 tons).
Bow, M'Lachlan and Co., Ltd., Paisley (13 vessels, 7845 tons, 21,200 I.H.P.).
Brown, George and Co., Greenock (6 vessels, 1932 tons).
Brown, John and Co., Ltd., Clydebank (7 vessels, 65,050 tons, 295,300 I.H.P.).
Bruntisland S. B. Co., Ltd., Bruntisland (3 vessels, 9309 tons).
Caledon S. B. and Eng. Co., Ltd., Dundee (9 vessels, 13,732 tons, 9900 I.H.P.).
Cammell Laird and Co., Ltd., Birkenhead (5 vessels, 32,116 tons, 115,900 I.H.P.).

Campbeltown Shipbuilding Co., Ltd., Campbeltown (3 vessels, 3975 tons).
Camper and Nicholsons, Ltd., Southampton (1 vessel, 750 tons).
Chalmers, W. and Co., Glasgow (19 vessels, 2319 tons).
Clark, Geo., Ltd., Sunderland (48,882 I.H.P.).
Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow (4 vessels, 4280 tons, 8340 I.H.P.).
Connell, Chas. and Co., Ltd., Glasgow (3 vessels, 17,129 tons).
Cooper and Greig, Dundee (16,000 I.H.P.).
Cran and Somerville, J., Leith (2 vessels, 936 tons, 2580 I.H.P.).
Craig, Taylor and Co., Ltd., Stockton-on-Tees (4 vessels, 21,083 tons).
Crighton and Co., Ltd., Chester (12 vessels, 2182 tons).
Crown, John and Sons, Ltd., Sunderland (2 vessels, 3840 tons).
Cumming, D. M., Glasgow (12 vessels, 1103 tons).
Denny, Wm. and Brothers, Ltd., Dumbarton (21 vessels, 15,357 tons, 94,800 I.H.P.).
Dickinson, J. and Sons, Ltd., Sunderland (30,760 I.H.P.)
Dixon, Sir R. and Co., Ltd., Middlesbrough-on-Tees (4 vessels, 12,310 tons).
Dobson, W. and Co., Newcastle-on-Tyne (2 vessels, 8206 tons).
Douglas and Grant, Kirkcaldy (12,900 I.H.P.).
Doxford, W. and Sons, Ltd., Sunderland (12 vessels, 66,084 tons, 33,393 I.H.P.).
Dublin Dockyard Co., Ltd., Dublin (6 vessels, 7800 tons).
Duncan, Robt. and Co., Ltd., Port Glasgow (5 vessels, 25,359 tons).
Dundee S. B. Co., Ltd., Dundee (4 vessels, 4033 tons).
Dunlop, Bremner and Co., Ltd., Port Glasgow (5 vessels, 17,216 tons, 11,100 I.H.P.).
Dunsmuir and Jackson, Glasgow (52,500 I.H.P.).
Duthie Torry Co., J., Aberdeen (4 vessels, 1578 tons).
Earle's S. B. and Eng. Co., Ltd., Hull (4 vessels, 19,965 tons, 23,750 I.H.P.).
Edwards and Co., Ltd., Millwall, London (8 vessels, 1005 tons).
Eltringhams, Ltd., Willing Quay-on-Tyne (5 vessels, 5780 tons, 6008 I.H.P.).
Fairfield Shipbuilding and Engineering Co., Ltd., Glasgow (4 vessels, 13,977 tons, 198,000 I.H.P.).
Fawcett, Preston and Co., Ltd., Liverpool (4080 I.H.P.).
Ferguson Bros. (Port Glasgow), Ltd., Port Glasgow (7 vessels, 3613 tons, 10,100 I.H.P.).
Fleming and Ferguson, Ltd., Paisley (7 vessels, 3300 tons, 8900 I.H.P.).
Forth Shipbuilding and Engineering Co., Ltd., Alloa (10 vessels, 18,985 tons, 3900 I.H.P.).
Fullerton, John and Co., Paisley (4 vessels, 1910 tons).
Furness S. B. Co., Ltd., Haverton-on-Tees (5 vessels, 32,750 tons).
Goole S. B. and Repairing Co., Ltd., Goole (8 vessels, 3755 tons).
Grangemouth Dockyard Co., Ltd., Grangemouth (6 vessels, 10,905 tons).
Gray, Wm. and Co. (1918), Ltd., West Hartlepool (13 vessels, 53,117 tons, 48,920 I.H.P.).
Gray, W. and Co., Ltd., Sunderland (3 vessels, 15,982 tons).
Grayson, H. and Co., Ltd., Garston (4 vessels, 9744 tons).
Greenock Dockyard Co., Ltd., Greenock (4 vessels, 20,800 tons).
Grey and Co., Ltd., South Shields (4564 I.H P.).
Hall, A. and Co., Ltd., Aberdeen (13 vessels, 1248 tons, 3240 I.H.P.).
Hall, Russell and Co., Ltd., Aberdeen (15 vessels, 4634 tons, 7890 I.H.P.).
Hamilton, Wm. and Co., Ltd., Port Glasgow (4 vessels, 22,235 tons).
Harkness, W. and Son, Ltd., Middlesbrough-on-Tees (4 vessels, 3784 tons).
Harland and Wolff, Ltd., Belfast (14 vessels, 110,180 tons, 132,450 I.H.P.).
Harland and Wolff, Ltd., Glasgow (9 vessels, 49,565 tons, 28,300 I.H.P.).
Harland and Wolff, Ltd. (Caird and Co., Ltd.), Greenock (5 vessels, 26,306 tons, 30,100 I.H.P.).
Hawthorne, Leslie, R. W., and Co., Ltd., Newcastle-on-Tyne (3 vessels, 14,857 tons, 134,420 I.H.P.).
Hawthorns and Co., Ltd., Leith (5 vessels, 2624 tons, 7370 I.H.P.).
Hebbles, Ltd., South Shields (2 vessels, 550 tons).
Henderson, D. and W. and Co., Ltd., Glasgow (5 vessels, 26,363 tons, 24,800 I.H.P.).
Inglis, A. and J., Ltd., Glasgow (4 vessels, 5502 tons, 9300 I.H.P.).
Irvine's S. B. and D. D. Co., Ltd., West Hartlepool (7 vessels, 30,055 tons).
Kincaid, J. G. and Co., Glasgow (70,100 I.H.P.).
Laing, Sir J. and Co., Ltd., Sunderland (5 vessels, 28,973 tons).
Lea S. B. Co., Ltd., Canning Town, London (12 vessels, 1392 tons).
Lewis, John, and Sons, Aberdeen (5 vessels, 2850 tons, 7150 I.H.P.).
Lithgows, Ltd., Port Glasgow (12 vessels, 66,829 tons).
Lloyd Royal Belge (Gt. Britain), Ltd., Glasgow (5 vessels, 14,370 tons).
Lobnitz and Co., Ltd., Renfrew (10 vessels, 5894 tons, 13,670 I.H.P.).

Lytham S. B. and Eng. Co., Ltd., Lytham (8 vessels, 1978 tons, 5250 I.H.P.).
McColl and Pollock, Ltd., Sunderland (8875 I.H.P.).
Metropolitan-Vickers, Ltd., Manchester (14,400 I.H.P.).
M'Kie and Baxter, Govan, Glasgow (29,475 I.H.P.).
Murdock and Murray, Ltd., Port Glasgow (6 vessels, 4035 tons).
Napier and Miller, Ltd., Old Kirkpatrick, nr. Glasgow (4 vessels, 18,359 tons).
North British Diesel Engine Works, Ltd., Glasgow (28,640 I.H.P.).
North Eastern Mar. Eng. Co., Ltd., Sunderland (27,245 I.H.P.).
North Eastern Mar. Eng. Co., Ltd., Wallsend-on-Tyne (69,935 I.H.P.).
North of Ireland S. B. Co., Ltd., Londonderry (7 vessels, 14,421 tons).
Northumberland S. B. Co., Ltd., Howden-on-Tyne (8 vessels, 45,078 tons).
Osbourne, Graham and Co., Sunderland (5 vessels, 10,130 tons).
Palmers Shipbuilding Co., Ltd., Hebburn-on-Tyne (9 vessels, 44,480 tons, 66,000 I.H.P.).
Parsons Marine Steam Turbine Co., Ltd., Wallsend-on-Tyne (101,300 I.H.P.).
Pickersgill, W. and Sons, Ltd., Sunderland (4 vessels, 21,311 tons).
Plenty and Son, Ltd., Newbury (30,000 I.H.P.).
Pollock, James, Sons and Co., Taversham (3 vessels, 686 tons).
Priestman, J. and Co., Sunderland (4 vessels, 12,341 tons).
Ramage and Ferguson, Leith (4 vessels, 8365 tons, 5593 I.H.P.).
Rankin and Blackmore, Ltd., Greenock (22,930 I.H.P.).
Readhead, John and Sons, Ltd., South Shields (4 vessels, 21,076 tons, 12,400 I.H P.)
Rennie Forrestt S. B., Eng., and D. D. Co., Ltd, Wyvenhoe (6 vessels, 1048 tons).
Rennoldson, J. P. and Sons, Ltd., South Shields (4 vessels, 1102 tons, 1920 I.H P.)
Richardson, Duck and Co., Ltd., Stockton-on-Tees (4 vessels, 20,913 tons).
Richardsons, Westgarth and Co., Ltd., Sunderland (65,400 I.H.P.).
Ritchie, Graham and Milne, Glasgow (10 vessels, 2000 tons).
Rollo, D. and Sons, Ltd., Liverpool (4400 I.H.P.).
Ropner S. B. Co., Stockton-on-Tees (5 vessels, 22,533 tons).
Ross and Duncan, Glasgow (18,800 I.H.P.).
Rowan, D. and Co., Glasgow (50,310 I.H.P.).
Scott and Sons, Glasgow (7 vessels, 1509 tons).
Scotts' Shipbuilding and Engineering Co., Ltd., Greenock (5 vessels, 19,529 tons, 101,000 I.H.P.).
Shields Engineering and D. D. Co., Ltd., North Shields (8000 I.H.P.).
Short Bros., Ltd., Sunderland (3 vessels, 15,771 tons).
Simons, Wm. and Co., Ltd., Renfrew (9 vessels, 5980 tons, 17,700 I.H.P.).
Smith's Dock Co., Ltd., Middlesbrough (10 vessels, 7998 tons).
Stephen, Alex., and Son, Ltd., Glasgow (5 vessels, 21,251 tons, 43,000 I.H.P.).
Sunderland S. B. Co., Ltd., Sunderland (4 vessels, 21,208 tons).
Swan, Hunter and Wigham Richardson, Newcastle-on-Tyne (15 vessels, 62,020 tons, 35,118 I.H.P.).
Swan, Hunter and Wigham Richardson, Ltd., Sunderland (7 vessels, 11,126 tons).
Thompson, R. and Sons, Ltd., Sunderland (2 vessels, 8331 tons).
Thornycroft, J. I. and Co., Ltd., Southampton (6 vessels, 5980 tons, 127,260 I.H.P.).
Tyne Iron S. B. Co., Ltd., Willington Quay-on-Tyne (4 vessels, 12,268 tons).
Vickers, Ltd., Barrow-in-Furness (3 vessels, 33,550 tons, 57,860 I.H.P.).
Wallsend Slipway and Engineering Co., Ltd., Wallsend (206,680 I.H.P.).
Weir, G. and J., Ltd., Cathcart, Glasgow.
White, J. Samuel and Co., Ltd., East Cowes (40 vessels, 7326 tons, 56,980 I.H.P.).
Wood, Skinner and Co., Ltd., Newcastle-on-Tyne (3 vessels, 8569 tons).
Workman, Clark and Co., Ltd., Belfast (13 vessels, 8763 tons, 58,100 I.H.P.).
Yarrow and Co., Scotstoun (8 vessels, 4285 tons, 92,650 I.H.P.).

LIST OF THE PRINCIPAL FOREIGN SHIPBUILDERS, MARINE ENGINEERS, AND REPAIRERS.

(*Showing in brackets after their names the output of each for* 1919.)

A/S Akers Mek. Verksted, Kristiana, Norway (1 vessel, 500 tons, 400 I.H.P.).
American Int. Corp., Hog Island, U.S.A. (60 vessels, 347,040 tons).
American Shipbuilding Co. (6 yards), Cleveland, O., U.S.A. (98 vessels, 256,016 tons, 135,600 I.H.P.).

Ansaldo, G. and Co., Sestri Ponente, Italy (3 vessels, 16,077 tons, 8832 I.H.P.).
Antwerp S. B. Co., Antwerp, Belgium (2 vessels, 3450 tons).
Asano Shipbuilding Co., Ltd., Tsurumi and Tokyo, Japan (5 vessels, 30,977 tons).
Australian Dockyards (9 vessels, 25,122 tons, 9400 I.H.P.).
Baltimore Dry Docks and S. B. Co., Baltimore, U.S.A. (11 vessels, 51,885 tons, 9500 I.H.P.).
A/S Bergens Mekaniske Verksted, Bergen, Norway (3 vessels, 4853 tons, 2400 I.H.P.).
Bethlehem S. B. Corpn. (5 yards), Bethlehem, Penn., U.S.A. (36 vessels, 179,500 tons, 84,000 I.H.P.).
Boele's S. B. Co., Bolnes and Slikkerveer, Holland (6 vessels, 9110 tons, 5950 I.H.P.).
Burgerhout S. B. and E. Co., Ltd., Rotterdam, Holland (1 vessel, 2000 tons, 1700 I.H.P.).
Burmeister and Wain, Ltd., Copenhagen, Denmark (2 vessels, 10,734 tons, 5750 I.H.P.).
Cadiz, Astilleros de, Cadiz, Spain (5 vessels, 5586 tons).
Canadian Allis Chambers, Ont., Canada (28,000 I.H.P.).
Canadian Vickers, Montreal, Canada (7 vessels, 36,828 tons, 18,100 I.H.P.).
Cantieri Navali Riuniti, Genoa, Italy (1 vessel, 6167 tons, 2600 I.H.P.).
Cantieri San Rocco, S.A., Trieste, Italy (2 vessels, 13,089 tons).
Chantiers Augustin-Normand, Havre, France (4 vessels, 2854 tons, 3950 I.H.P.).
Chantiers de Bretagne, Nantes, France (4 vessels, 6784 tons, 12,200 I.H.P.).
Chantiers de la Gironde, Bordeaux, France (7 vessels, 2600 tons).
Chantiers de la Loire, Paris, France (19 vessels, 12,600 tons, 26,600 I.H.P.).
Chantiers de Saint Malo, France (8 vessels, 2983 tons).
Chantiers Maritimes du Sud-Ouest, Paris, France (6 vessels, 6000 tons).
Chantiers de la Méditerranée, Paris, France (13 vessels, 10,893 tons, 20,800 I.H.P.).
Chantiers de St. Nazaire Penhöet, Paris, France (8 vessels, 12,000 tons, 6000 I.H.P.).
Chantiers de Provence, Port de Bouc, France (8 vessels, 6735 tons, 3000 I.H.P.).
Cockerill, John and Co., Antwerp, Belgium (22 vessels, 2808 tons, 1920 I.H.P.).
Collingwood S. B. Co., Ltd., Collingwood, Ont., Canada (6 vessels, 14,460 tons, 7200 I.H.P.).
Columbia River S. B. Co., Portland, U.S.A. (25 vessels, 154,475 tons).
Copenhagen Navy Yard, Denmark (5 vessels, 2400 tons, 5000 I.H.P.).
Copenhagen S. B. Co. (4 vessels, 4878 tons, 2440 I.H.P.).
Coughlan, J., and Sons, B.C., Canada (7 vessels, 40,672 tons).
Cramp, W., and Sons, Philadelphia, Pa., U.S.A. (14 vessels, 27,550 tons, 341,600 I.H.P.).
Davie S. B. Co., Quebec., Canada (16 vessels, 15,527 tons).
"De Schelde" Co., Flushing, Holland (2 vessels, 3598 tons, 11,400 I.H.P.).
Dominion Bridge Co., Montreal, Canada (13,000 I.H.P.).
Dominion S. C. Co., Toronto, Ont., Canada (8 vessels, 19,920 tons).
Dyle et Bacalan, Bordeaux, France (2 vessels, 2800 tons).
Eriksbergs Works, Gothenburg, Sweden (4 vessels, 4500 tons, 1800 I.H.P.).
Esercizio Bacini, Riva Trigoso, Italy (2 vessels, 11,602 tons, 4500 I.H.P.).
Euskalduna, Ca. de Construccion, Bilbao, Spain (2 vessels, 5342 tons, 450 I.H.P.).
Federal S. B. Co., Kearney, N.J., U.S.A. (23 vessels, 154,660 tons).
Fijenoord Co., Rotterdam, Holland (2 vessels, 15,000 tons, 20,000 I.H.P.).
Fedriksstad Mek. Verksted, Fredriksstad, Norway (9 vessels, 16,540 tons, 7425 I.H.P.).
General Elec. Co., Schenectady, N.Y., U.S.A. (320,000 I.H.P.).
Götaverken, Gothenburg, Sweden (4 vessels, 16,400 tons, 10,150 I.H.P.).
Gouldie, M'Culloch Co., Ont., Canada (29,000 I.H.P.).
Great Lakes Eng. Works (2 yards), Detroit, Mich., U.S.A. (40 vessels, 103,518 tons, 57,600 I.H.P.).
Harbour Marine Co., B.C., Canada (2 vessels, 10,600 tons).
Hong Kong and Whampoa D. Co., Hong Kong (7 vessels, 26,782 tons, 17,400 I.H.P.).
Hoover, Owens, and Reutschler Co., Ont., Canada (86,000 I.H.P.).
Inglis, J. and Co., Toronto, Ont., Canada (30,000 I.H.P.).
Kanasaki Dockyard Co., Kobe, Japan (14 vessels, 76,775 tons).
Kockums Mek. Verks, Malmö, Sweden (5 vessels, 7900 tons, 5700 I.H.P.).
Limhamns S. B. Co., Limhamns, Sweden (4 vessels, 5652 tons, 2250 I.H.P.).
Lindholmen Co., Gothenburg, Sweden (3 vessels, 7960 tons, 3900 I.H.P.).
Llewellyn Iron Works, Los Angeles, U.S.A. (140,000 I.H.P.).
Longbeach S. B. Co., Long Beach, Cal., U.S.A. (6 vessels, 31,000 tons).
Lyall, Wm., S. B. Co., B.C., Canada (8 vessels, 11,840 tons).
Manitowac S. B. Co., Manitowac, Wis., U.S.A. (12 vessels, 29,742 tons).
Merchant S. B. Corp. (2 yards), Bristol, U.S.A. (28 vessels, 168,700 tons).
Mitsubishi Zosen Kaisha, Nagasaki and Kobe, Japan (5 vessels, 30,977 tons).

Moore S. B. Co., San Francisco, U.S.A. (22 vessels, 134,200 tons, 33,600 I.H.P.).
National S. B. Corp., Quebec, Canada (10 vessels, 11,430 tons).
Netherlands S. B. Co., Amsterdam, Holland (2 vessels, 14,000 tons).
Newport News S. B. Co., New York, U.S.A. (5 vessels, 35,017 tons, 12,000 I.H.P.).
New York S. B. Corp., Camden, New Jersey, U.S.A. (7 vessels, 62,795 tons, 13,050 I.H.P.).
New Waterway S. B. Co., Schiedam, Holland (3 vessels, 13,774 tons, 7250 I.H.P.).
North-West Steel Co., Portland, U.S.A. (18 vessels, 111,366 tons).
Oresunds Works, Landskrona, Sweden (3 vessels, 5870 tons).
Osaka Ironworks, Osaka, Japan (10 vessels, 56,400 tons).
Oskarshamn Works, Sweden (3 vessels, 4758 tons).
Pacific Construction Co., B.C., Canada (4 vessels, 12,000 tons).
Polson Iron Works, Ont., Canada (5 vessels, 12,255 tons, 8250 I.H.P.).
Port-Arthur S. B. Co., Port Arthur, Ont., Canada (6 vessels, 8612 tons, 6200 I.H.P.).
Rotterdam D. D. and S. B. Co. (10 vessels, 36,459 tons, 23,800 I.H.P.).
Scheepswerf Navis, Groningen, Holland (21 vessels, 11,650 tons).
Schneider et Cie., Le Creusot, France (2 vessels, 3000 tons, 5000 I.H.P.).
Sestao, Astilleros de, Bilbao, Spain (2 vessels, 6000 tons).
Shanghai Dock Co., Shanghai, China (4 vessels, 16,200 tons, 19,600 I.H.P.).
Skinner and Eddy Corp., Seattle, Wash., U.S.A. (32 vessels, 177,700 tons, 16,800 I.H.P.).
South-West S. B. Co., Los Angeles, U.S.A. (18 vessels, 100,800 tons).
Spanish S. B. Co., Bilbao, Spain (6 vessels, 16,720 tons, 4450 I.H.P.).
Standard S. B. Corp., New York, U.S.A. (11 vessels, 55,532 tons, 27,500 I.H.P.).
Staten Island S. B. Co., Staten I., U.S.A. (16 vessels, 24,186 tons, 22,000 I.H.P.).
Submarine Boat Corp., New Jersey, U.S.A. (78 vessels, 285,402 tons).
Taikoo Dockyard Co., Hong Kong (7 vessels, 25,008 tons, 10,000 I.H.P.).
Tidewater S. B. Co., Quebec, Canada (4 vessels, 13,320 tons, 7500 I.H.P.).
Toledo S. B. Co., Toledo, O., U.S.A. (12 vessels, 30,151 tons, 17,100 I.H.P.).
Tosi, Franco, Cantieri Navali, Taranto, Italy (2 vessels, 8800 tons).
Union Construction Co., Oakland, Cal., U.S.A. (6 vessels, 35,946 tons).
Vuijk and Sons, Capelle, Holland (5 vessels, 14,000 tons).
Wallace Shipyards, B.C., Canada (5 vessels, 15,750 tons, 7500 I.H.P.).
Werf Conrad, Haarlem, Holland (6 vessels, 1170 tons).
Western Canada Yards, B.C., Canada (6 vessels, 13,986 tons).
Westinghouse Co. (2 shops), New York, U.S.A. (260,550 I.H.P.).

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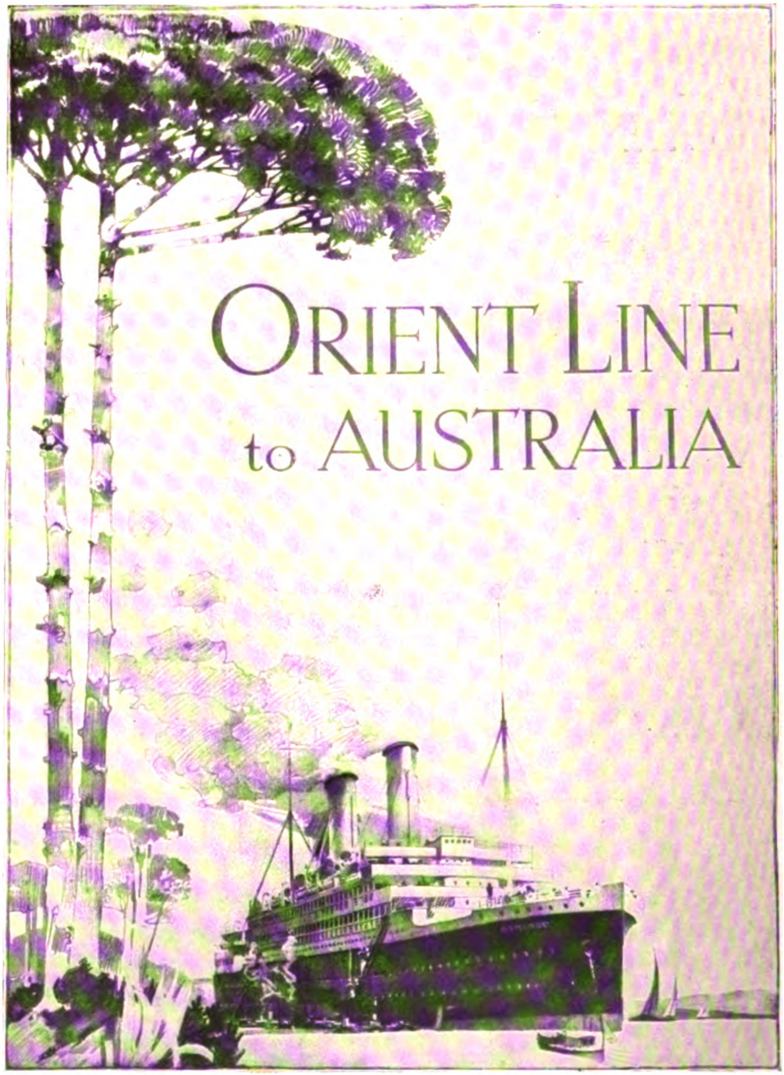

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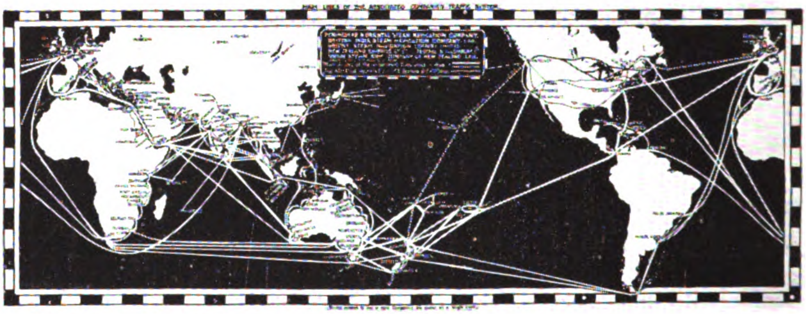

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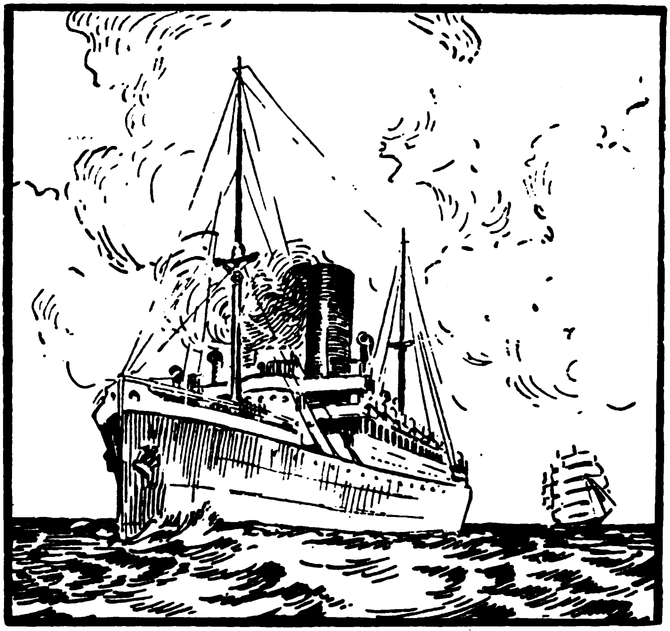

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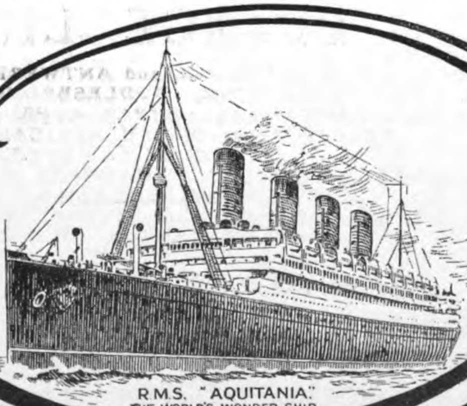

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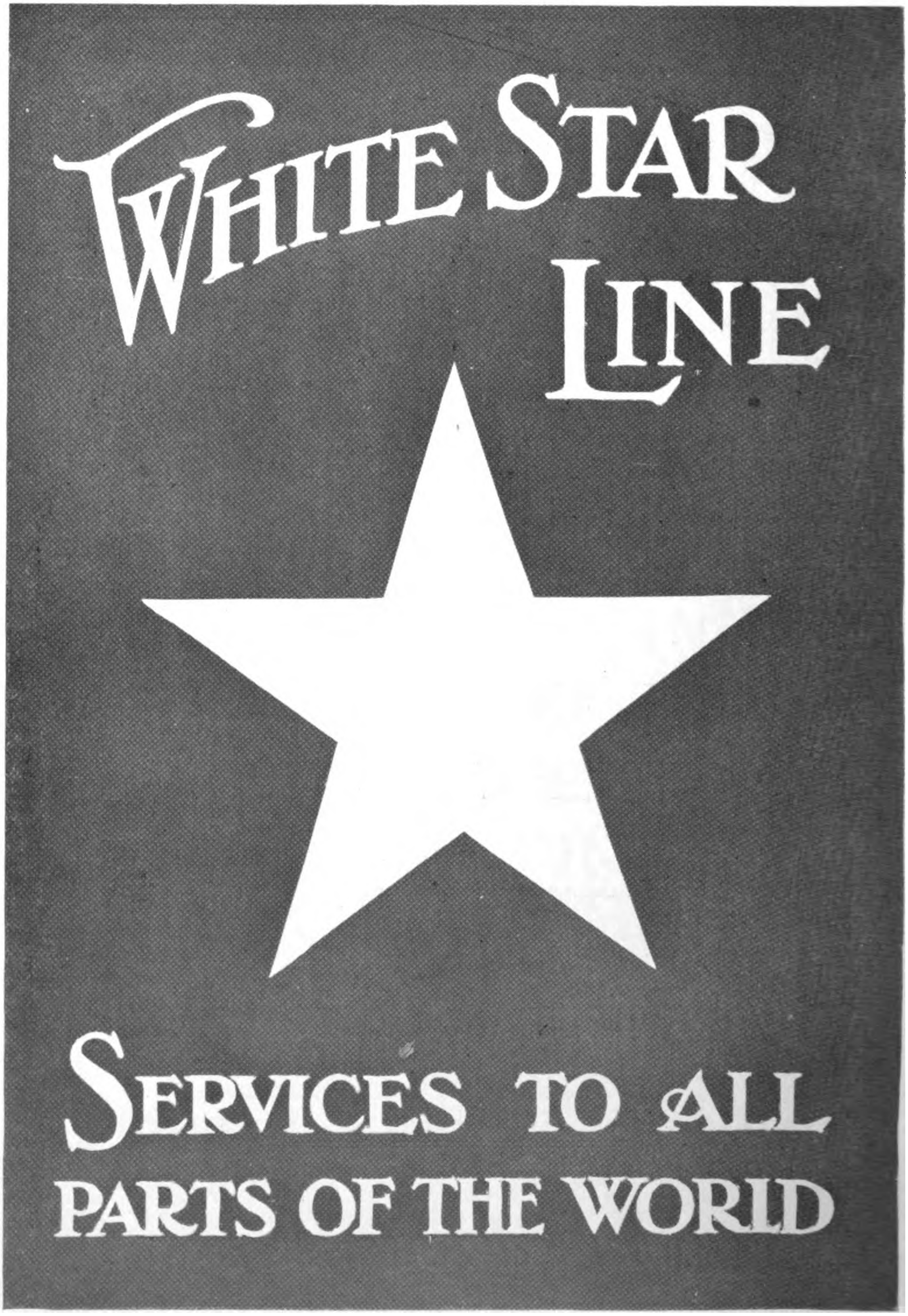
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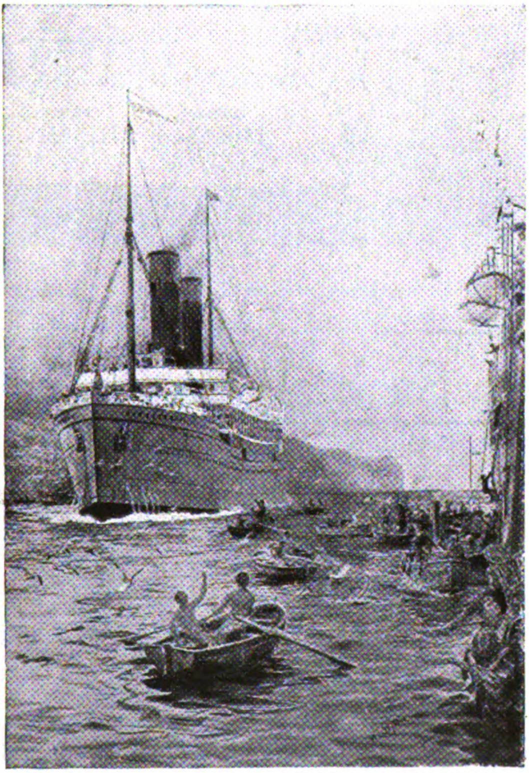

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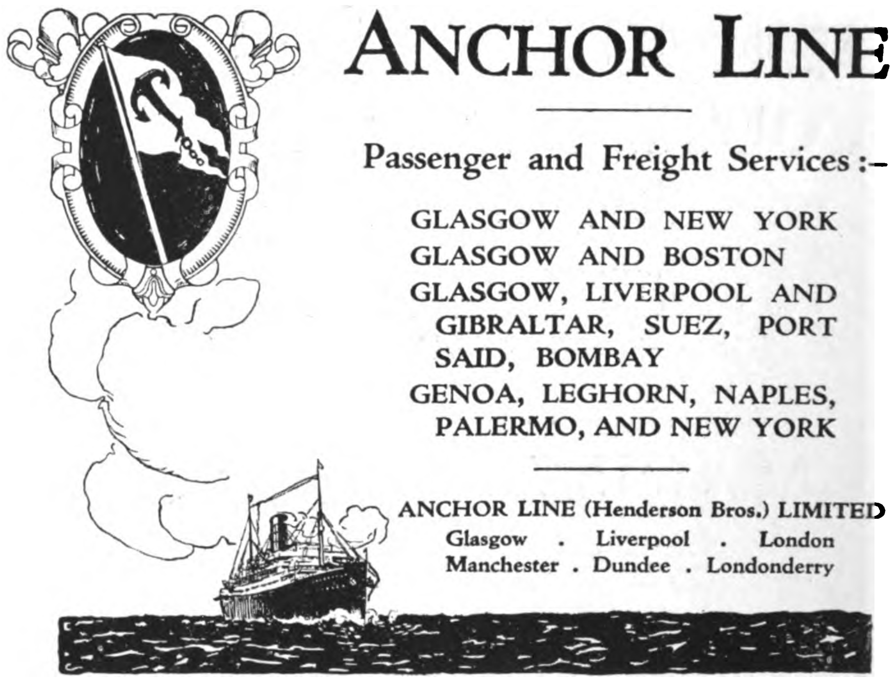

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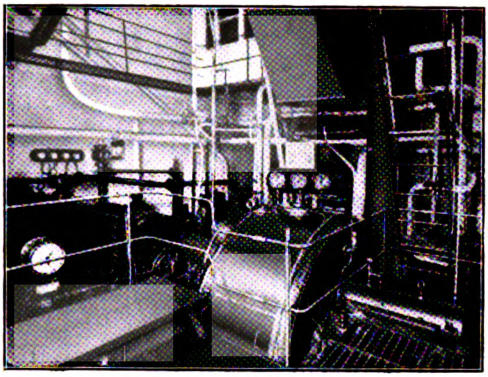

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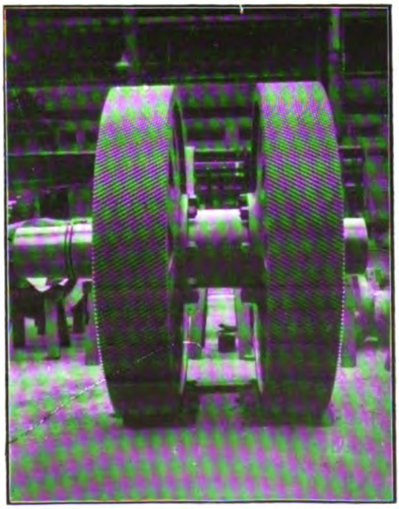

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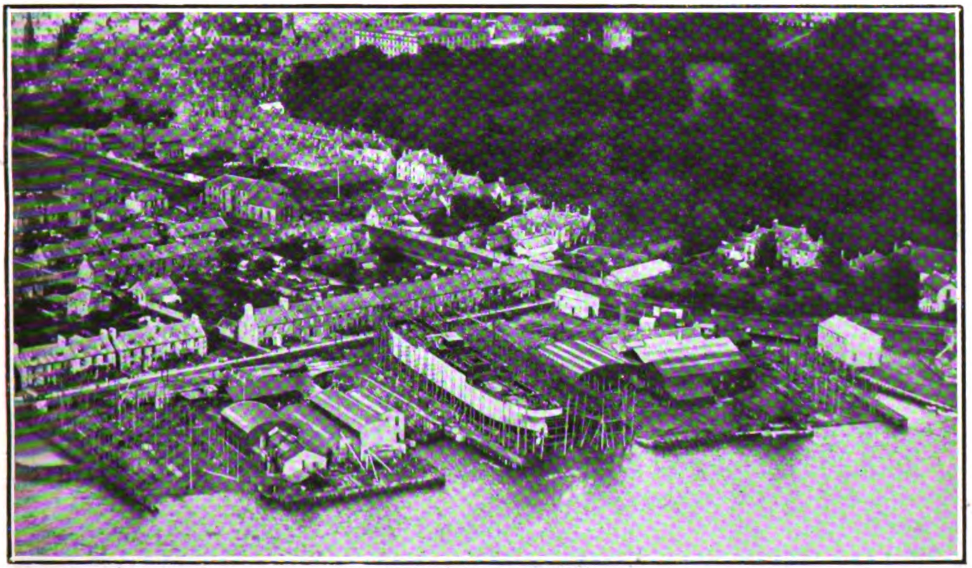

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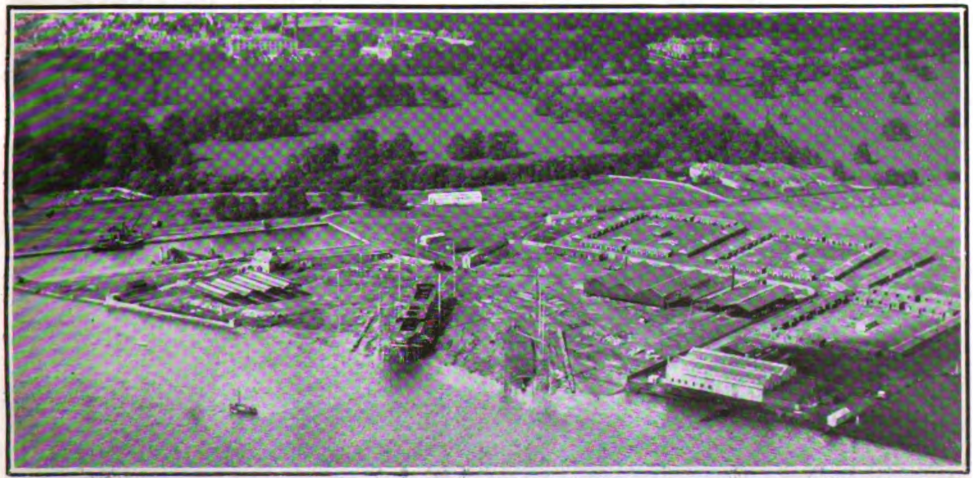

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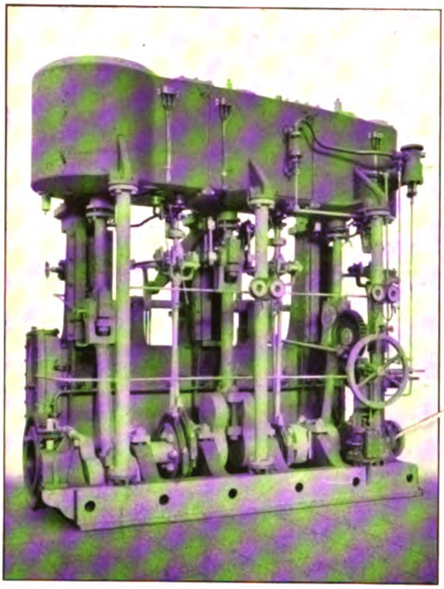

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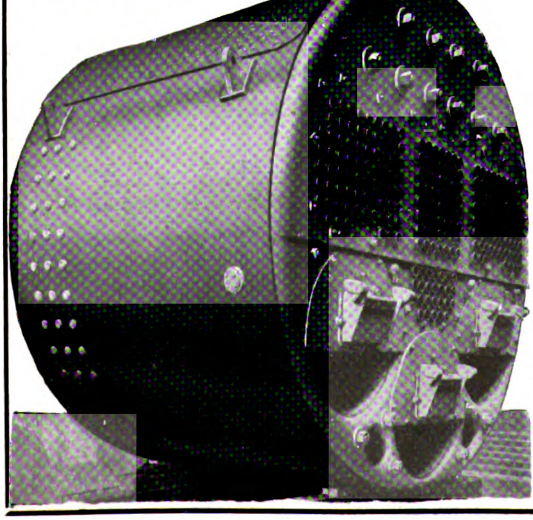

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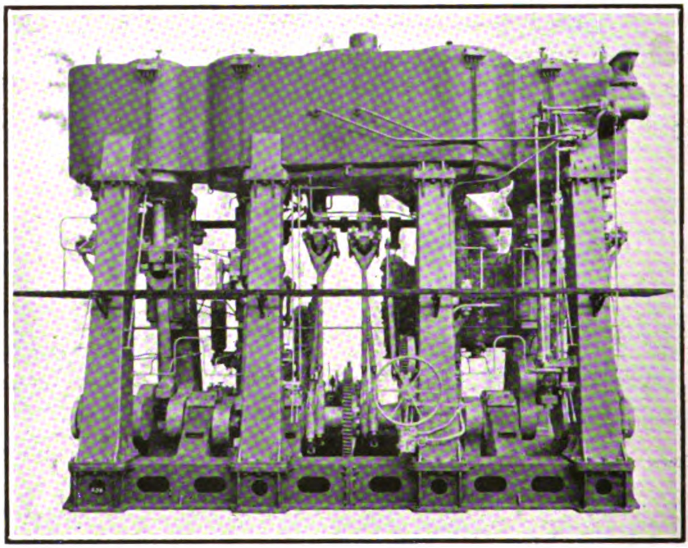

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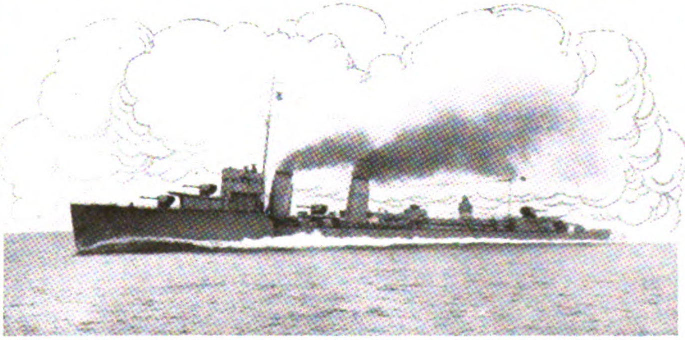

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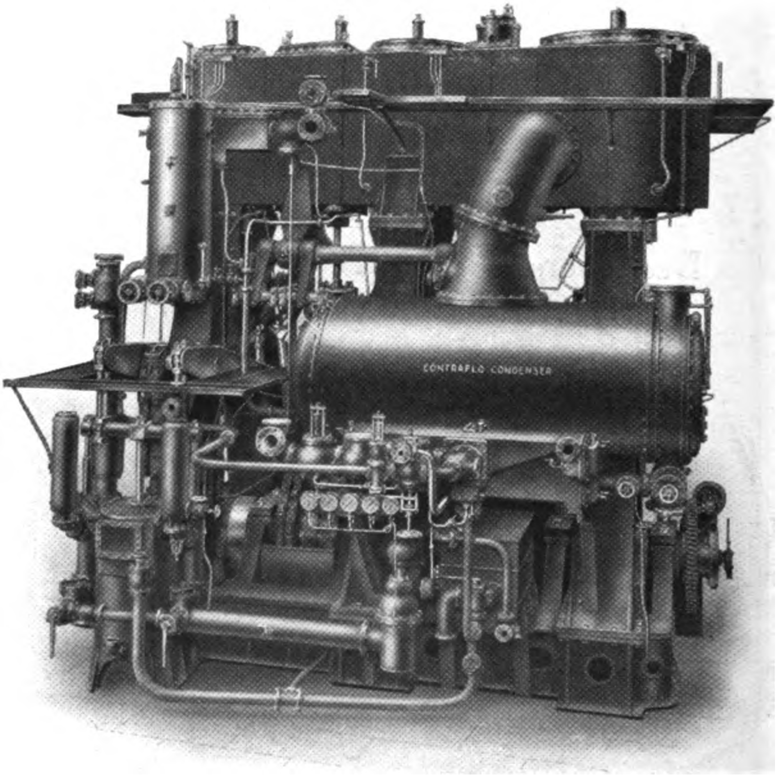

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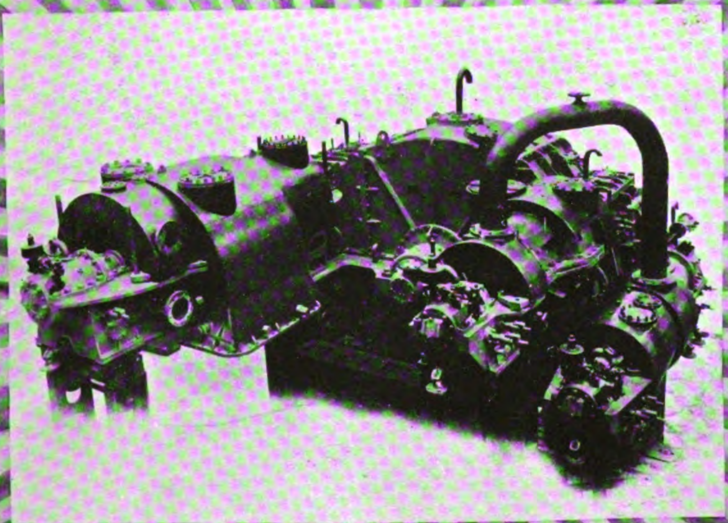

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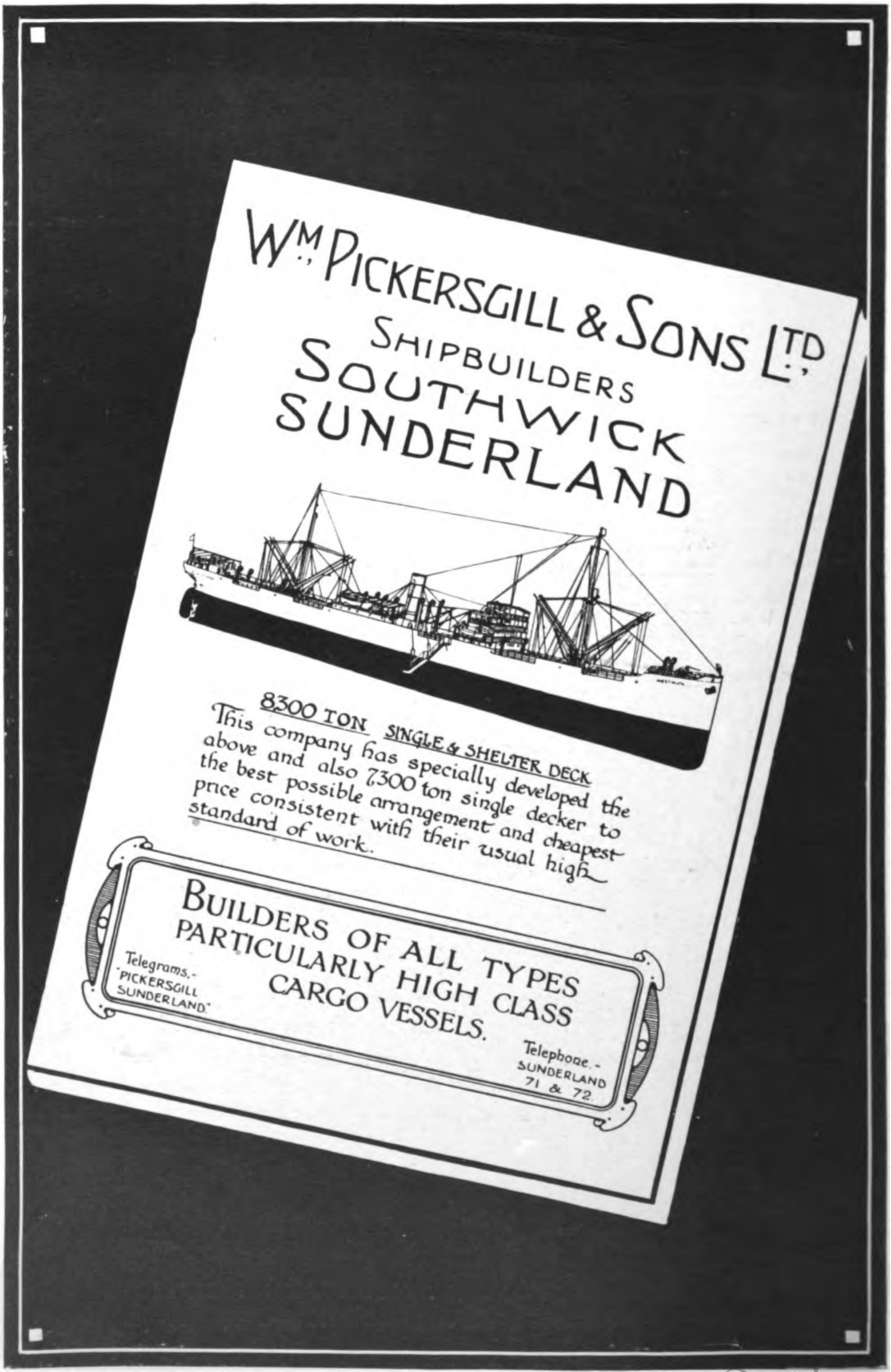

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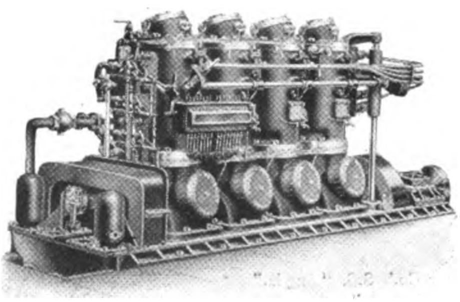

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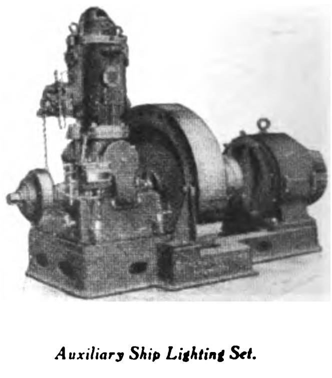

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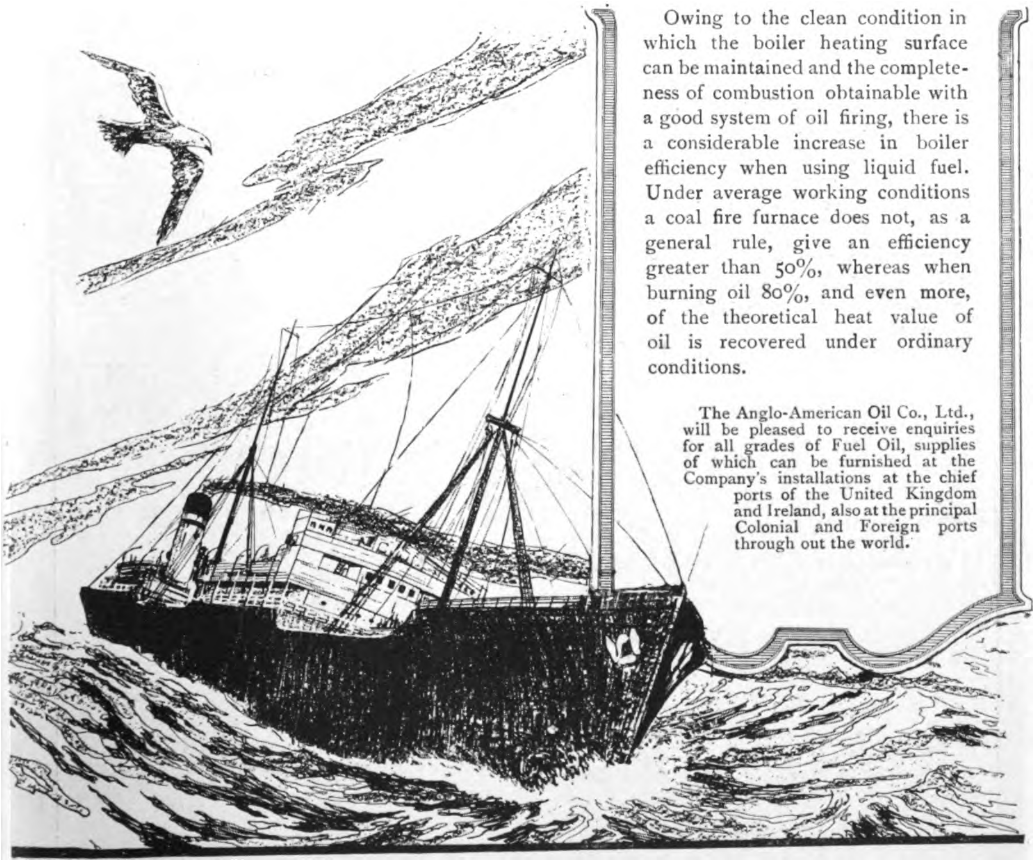

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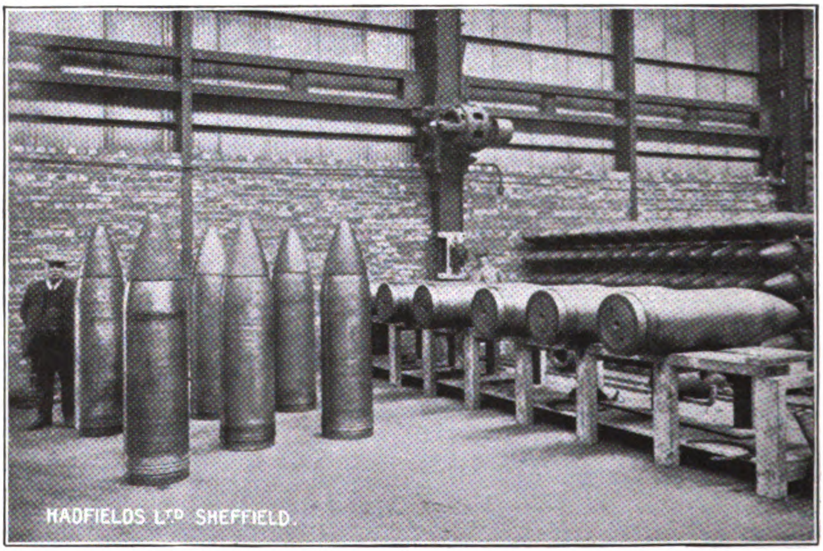

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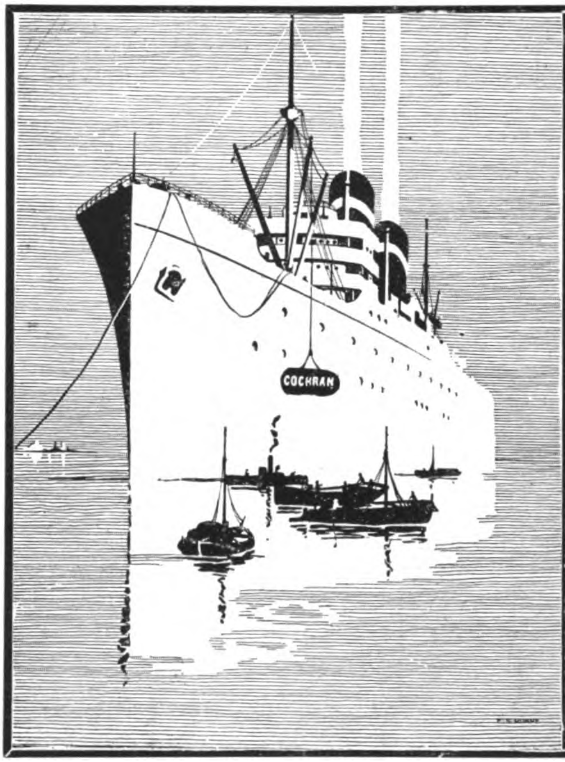

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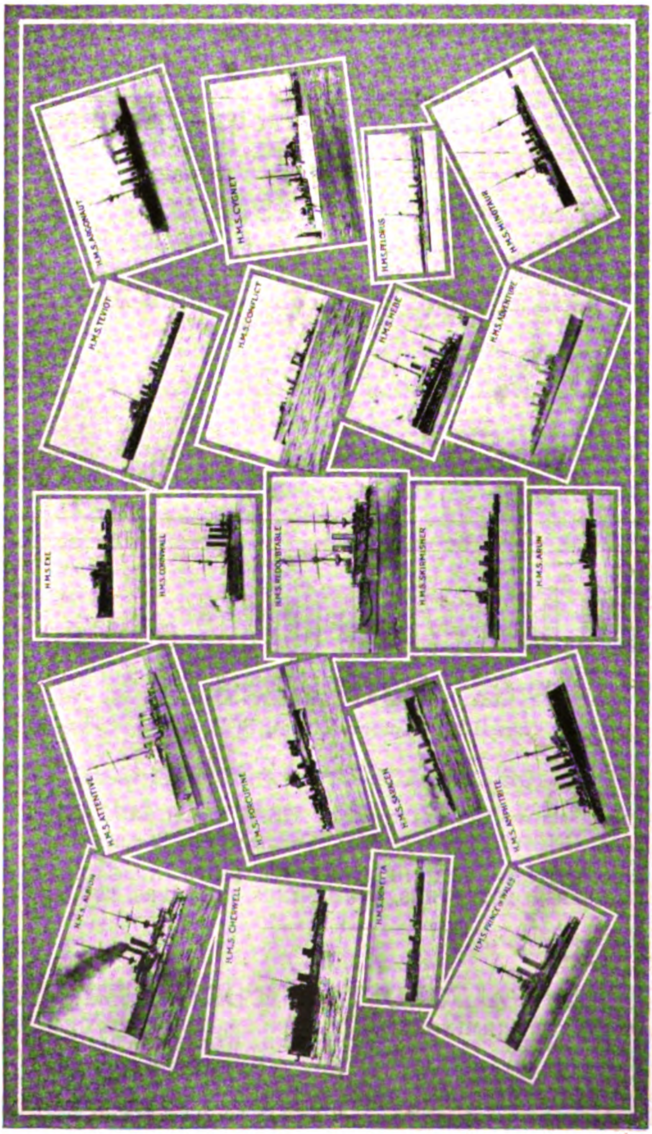

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